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Electrical World

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Electrical World

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W. H. ONKEN, JR. Editor — HAROLD V. BOZELL Editor

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Export Markets Can Be Obtained by Development

A REVIEW of the electrical export situation shows that during 1923 Germany exported 33 per cent of the total electrical goods shipped abroad from all countries, as compared with 52 per cent in 1913. Many obstacles have yet to be overcome by Germany before she can reach her former status in the world's electrical markets, but her eventual rehabilitation seems certain. In fact, Germany must have an export business greater than before the war in order to work out satisfactorily her payment of reparations. Germany's steady increase in her electrical exports and the aggressiveness being shown at the same time by other nations in getting a share of this business have caused American export sales to decrease. This should not, however, create a great deal of concern. Rather it should spur American manufacturers to greater efforts.

Many new markets are to be had, but they must be developed, and they must be developed by systematic and sustained sales activity. Africa, South America and other territories afford great opportunities for the upbuilding of markets for American goods, and American electrical manufacturers should turn to these new fields and direct serious effort to establishing their lines in these markets.

Service First— Price Second

FAIR rates are absolutely essential to good public utility service, but in seeking such rates executives should never forget that their customers are on the whole far more constantly interested in service quality than in service cost. The expense of utilizing electricity in the home and in business is so small a proportion of the total operating budget of either class of users that the kind of service received well-nigh overshadows the outlay which it requires on the part of the consumer. It is characteristic of American ways of living and working that so long as service is excellent bills are paid, by and large, without complaint, assuming, of course, that rates fall within reasonable brackets.

Poor service, on the other hand, offers a rickety foundation for decent public relations and a wretched base on which to plan a campaign for higher rates. If the service is below par, the first duty of the company is to acknowledge the fact and to leave no stone unturned to improve it. The situation may demand higher rates, but if so, let due emphasis be placed upon what these rates will do for the service as well as for the return upon the capital honestly and prudently invested in the property. In occasional instances service in certain localities may be temporarily so poor as scarcely to be worth the old prices, and in such districts a campaign for higher rates is likely to run against stiff opposition. A convincing demonstration of the company's vigorous determination to improve the service should form an essential part of its conduct of affairs in such a situation. There is much to lose by shutting the executive eye to the fact that the service may badly need improvement, and whether the cause is subnormal efficiency in operation, lack of equipment or something else, a well-managed rate readjustment should be "tied in" with potential or tangible service improvements whenever possible.

Causes of Instability in Industry

SO LONG as an industry is underdeveloped it can weather storms without knowing exactly why. This at present is one of the saving graces of the electrical industry. Older industries have learned through bitter experience that they must be in possession of vital trade facts if they are not to be buffeted by every adverse trade wind that blows. While no amount of knowledge can convert depression into prosperity, acquaintance with basic trade statistics can keep an industry stable in any storm, provided, of course, that proper use is made of the facts.

Thus, for example, we read: "One hundred and nineteen mills reporting to the West Coast Lumbermen's Association for the week ended October 25 manufactured 102,679,916 feet of lumber, sold 85,577,101 feet and shipped 88,552,605 feet. New business was 17 per cent below production. Shipments were 3 per cent above new business." Again another industry reports, besides the production, shipments and stocks on hand, that its September production showed an increase of 2 per cent over August, following a 7 per cent increase in August over July. It is facts like these that make for stability in industry. On the other hand, the coffee market, for example, has been very erratic for the last few months. Why? The following quotation tells in an admirable manner: "A shortage of 4,000,000 bags in supplies some think is exaggerated; half that is regarded in some quarters as the more probable consumption. Yet others think that that would be bad enough. Some think the carryover was much underestimated. Some 75 per cent of the coffee received in the United States in the last four months has been of the higher grades. What has become of the low grades? Was the original estimate of the carryover 2,000,000 bags too low? There are those who suspect so." Guesswork and instability as compared with knowledge and stability.

Not long ago the manufacturers of fractional-horsepower motors were suddenly confronted by the cold and disquieting fact of overproduction. As a consequence there were many heartaches and not a few losses. Industry statistics would have forestalled any such situation; and we still lack the statistics of production, sales and stocks on hand. Eventually, as

the electrical industry begins to approach its saturation point, this lack will be serious. Why not follow the example of more mature and stabilized industries and gather vital statistics of production now?

Standardization— Where It Is Not

MOST great merchants have made their success by visualizing the customer's viewpoint. That the customer has a viewpoint in standardization, however, is not always appreciated, particularly in foreign or "world" markets. Yet that he has this viewpoint was emphasized by a leading South African electrical engineer who has been doing a good deal of buying in recent years and has been trying to get any benefits that may accrue from international competition. His conclusions may best be summed up in a question almost of despair: "How do I know what I am going to get when I receive tenders from six or seven different countries, if there is no standardization—if ten horsepower means six or seven different things, depending on who says it? The result is that I take, naturally, what I know."

Electrical manufacturers the world over are, by human nature, inclined to follow their own previous procedure rather than change to one which seems to make concessions. But a close study of the work already accomplished and now being done by the International Electrotechnical Commission will show them that this work is very much to their benefit, as well as to that of the customer. A more intensive study of world market competition must convince the manufacturer that his best interests lie in the direction of intelligent international standardization. Experiences "where standardization is not" strongly confirm this.

Sell Appliances at a Profit and Additional Load Must Naturally Follow

THAT central-station companies, even in small towns, can conduct their appliance sales departments on a self-supporting basis and thereby put additional load upon their lines without having to charge a deficit to promotion expense is pretty conclusively demonstrated in the results obtained by the Twin State Gas & Electric Company, described on page 1153 of this issue of the ELECTRICAL WORLD. Conditions under which this company showed a net profit of 6.4 per cent on a gross merchandising business of less than $90,000 were not ideal, which makes the accomplishment even the more noteworthy. The towns were widely scattered and comparatively small, and therefore a large, closely supervised sales department was out of the question. But by careful buying, judicious advertising, rapid turnover, attention to overhead expenses and liberal commissions to salesmen the company's merchandising operations are conducted at a profit.

The outstanding feature of the Twin State company's sales department is that it looks first to selling appliances, knowing that increased revenue from the energy that they will consume must come as a natural consequence. How well this has worked out may be seen in one town of 16,000 people where four hundred electric ranges are in use earning a gross annual revenue of more than $25,000. These ranges were sold at a profit and this load was not gained at a heavy cost for promotion. On other appliances similar results have been shown.

What this company has accomplished in its merchandising operations should be most encouraging to other central-station commercial men. It shows that selling appliances for their load-building value alone, regardless of red figures at the end of the year, is no longer necessary. Conducted on an ethical, businesslike basis, with the avowed purpose of making a profit, the sales volume is just as large and the energy consumption is all clear gain.

The Wider Possibilities of Employee Ownership

IT IS estimated that the normal growth of the electric light and power companies of the country calls for more than half a billion dollars a year of new capital. While the various state utility commissions are disposed to sanction rates that give a fair return on the money invested, it is impossible to provide new capital out of earnings. The central-station companies are, therefore, constantly turning to the investment bankers of the country for the sale of their bonds and to their own customers and employees for a steady prefered-stock market.

While the bankers are doing an ever better job in popularizing electric power and light bonds, it seems doubtful whether they can build the demand for this class of securities as rapidly as the needs require. The work of the power and light companies in selling their preferred stocks to their customers has gone ahead with great success for some years, and, in addition to the favorable public relations resulting therefrom, this practice promises an ever-increasing source of new money.

One of the strongest arguments advanced in favor of power and light securities is the small number of employees required by the industry. In other words, one man can produce more dollars of gross income in this business than in any other large industry. The central-station company, therefore, cannot expect materially to improve its financial situation through the sale of its securities to its own employees. Much benefit undoubtedly comes from making stockholders out of employees, but it is along the line of building *esprit de corps* rather than of solving the financial problem.

There is a field, however, that may well receive the thought of the whole industry. It is made up of the vast army of men and women employed by the electrical manufacturers. These manufacturing companies are not under the supervision of utility commissions. They may care in a large measure for their expansion out of their net earnings, and yet it is the manufacturers who employ the largest number of people. If for any reason the central-station companies of the country cannot enlist new money to meet the steady demand for more and more service, the people in the shops of the electrical manufacturers will be the first to suffer, for the central station is the outlet directly or indirectly for most of these manufactured goods.

This is simply to call attention to the community of interest that would be instantly apparent if the industry were completely integrated; that is, if the manufacturers of electrical equipment owned the central stations of the country. They would then be directly responsible for raising the capital necessary for the utilization of their manufactured product, and they would undoubtedly find an important source of such capital in

the savings of their employees. The same funds are always available to the present managers of the electric light and power industry.

The Battle Against Cosine ϕ

THE electrical traveler in Europe cannot avoid being impressed with the universal attack being made on the problem which the European so graphically calls "the battle against cosine ϕ." On every side in Europe, as in this country, all kinds of attempts are being made to gain telling advantage in the struggle. There is a sortie there, a frontal attack here, a flanking movement somewhere else; the small condenser at the individual motor there, the large condenser for lump correction here, a unity or a leading power-factor motor somewhere else. And to complicate it all in places there is an attack from above in the form of rates, sometimes more confusing than effective. But cosine ϕ has not yet surrendered.

One of the attributes of good generalship is to know the enemy's position, to analyze his weakness and his strength. In this attribute, both in Europe and in America, there are signs of poor technique on the part of the general. It is unfortunate, and yet true, that the power-factor problem has not been analyzed to a greater degree. Attempts at solutions are made in too many instances without a complete comprehension of the various factors which enter the situation. The problem is recognized as serious by some, but its importance is not recognized by others—and only a few have started a comprehensive reconnaissance upon which to base a really intelligent campaign. These few should be supported. Eventually the battle will be won. The more intelligent the attack, the earlier will be the victory.

The League Council Goes to Work

THE announcement of the first meeting of the League Council has intensified the growing interest of electrical men of all groups in the progress of the development of local electrical leagues. This movement was initiated by the Society for Electrical Development three years ago in the calling of a conference of league representatives at Association Island. As a result of three such annual conferences a plan of confederation has been devised and a league council established to act in an advisory capacity both to the leagues and to the Society for Electrical Development, which has been officially requested to carry on the function of national league headquarters.

The simplicity of the plan is promising, and the action taken at the first meeting of the League Council may also be taken as a good omen in that there was no radical attempt to do anything spectacular. The council purposes to make a study of the problem of league financing and requests the society to investigate the possibilities for starting leagues in all cities of more than 100,000 population in the United States and Canada and to bring out a manual on league organization. It recommends standardization of the names of leagues—all practical steps toward the extension of league development. The council apparently recognizes the fact that no plan or policy which may be proposed will endure unless it is a natural process, for local leagues cannot be forced upon any community, nor can co-ordination of league activities be achieved unless the governing ideas and purposes are acceptable both to the leagues themselves and to the industry at large.

But enthusiasm for league organization is spreading steadily. New calls for aid in setting up leagues are coming in from all quarters of the country. The prospect is that the field men of the Society for Electrical Development who have been engaged in league promotion and service for several years will have all they can do. The support of this League Council gives their work legality and should be most helpful. The conviction is undoubtedly growing that these leagues can be made a great influence for market building, and the industry is clearly behind the idea. The council should and undoubtedly will have the earnest support of all the national group organizations.

Light Is the Spirit of the Holidays

ARTIFICIAL light plays an important part in the gala attire of our cities and towns in the period preceding and following Christmas. In homes, stores, hotels and elsewhere light heralds the coming of the holiday season and appropriately expresses its spirit. Many opportunities are to be found on every hand to spread the gospel of light.

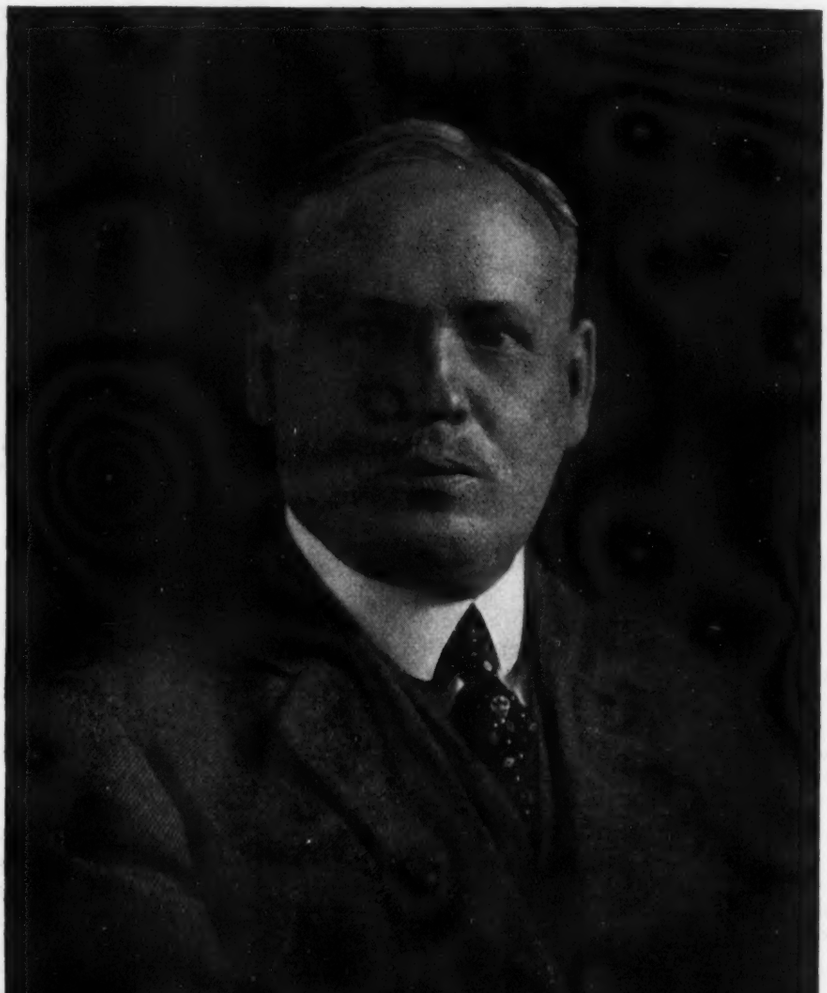
The show window—the welcoming hand of the store—can greet the public with light. It may be flooded both from concealed sources and from many small visible sources. Colorfulness may be introduced and the particularly symbolic colors—red and green—may be emphasized. Spotlamps, floods of colored light, myriads of tiny sparks of light and other symbols of Christmas may acclaim the Christmas spirit. The store may also call upon this valuable ally to enhance its decorations. It is appropriate at this time to increase the intensity of illumination. Portable lamps, strings of Christmas-tree bulbs and electric candles are desirable adjuncts. Merchants are finding that adequate lighting provides good advertising, is in itself a selling agency and influences favorably both customers and salespeople. If good lighting is desirable throughout other months of the year, certainly it should be still more desirable during the holiday period which is just beginning.

In the home the Christmas-tree outfit is now the standard equipment for the tree. These electric lamps are safe, and the electrically lighted tree may radiate its sentiment throughout the holiday week. Why not light up the homes for the occasion and then let the occasion last for twelve months a year? Why is not this the week to light all the "portables" in the house? And, speaking of portables, what better gift is there than one of these "home fires" of the electrical age? Would it not be appropriate to the season to illuminate all the porches? How symbolic of cheerfulness and prosperity the combined effect would be! Decorating live trees outdoors with electric lamps is a comparatively new idea which deserves to grow.

Truly, Christmas time affords an incentive toward utilizing the charm and the power of light. Furthermore, the pleasing effects of more light inevitably linger in the minds of those who have felt their influence. From an educational viewpoint—and education in lighting is still sorely needed—many opportunities are just now afforded those interested in the progress of illumination.

Robert Baird Williamson

An engineer of outstanding ability who has made notable contributions to the electrical industry in the design of large alternating-current machinery.



THE electrical industry despite its tremendous expansion and the consequent demand for power has intrusted the design of its heavy equipment to a very few engineers, these being men not only of sound technical training but keen in analysis and broad of view.

Robert B. Williamson is one of these men. As engineer in charge of alternating-current design for the Allis-Chalmers Manufacturing Company he has been responsible for the design of its alternating-current machinery, including many outstanding installations of the past two decades. As a textbook writer his name has been familiar to engineers and electrical students for a score of years.

Essentially he is an engineer. An indefatigable worker, quiet of manner and unassuming, he has yet a personality that at once inspires confidence. Outside of his business affiliations, he is known as a lover of the arts, of literature and music. He has traveled extensively and developed a keen sense of humor, his wit and anecdotes being enjoyed by all those who are intimately acquainted with him.

Mr. Williamson has taken an active part in the affairs of the American Institute of Electrical Engineers, serving on a number of important committees such as those concerned with standards, electrical machinery, etc. In 1921 he was elected as one of the managers of the Institute, which office he now holds.

Mr. Williamson was born at Smith's Falls, Ontario, Canada. On graduation from Cornell University in electrical engineering in the class of 1893 he engaged in electrical construction work for two years, which was followed by two years as chief draftsman for the Canadian General Electric Company. For three years he served as instructor in electrical engineering at Lehigh University and during this period did considerable textbook writing on alternating currents.

In 1905 he joined the electrical engineering staff of the Allis-Chalmers Company under the direction of B. A. Behrend. Since 1910 he has had charge of the design of all alternating-current rotating machinery built by that company. This work has included the design of large waterwheel and turbo-generators such as the 32,500-kva. unit installed at Niagara Falls in 1919 and the 65,000-kva. unit which was placed in operation there last fall, the 35,000-kva. units for the Pit River No. 1 plant of the Pacific Gas & Electric Company, and others.

Economies of Distribution

An Extension of Kelvin's Law to Secondary Mains, Underground Cables and Transformers—Specific Applications of the Principles to Circuits —Economic Versus Temperature Ratings

By J. F. H. DOUGLAS
Associate Professor of Electrical Enginering, Marquette University

THE economic solution of distribution problems is of great importance in the present state of the art, when many systems are changing circuits and equipment to keep pace with the great increases in the demands for service. Most of these solutions involve many factors difficult to determine, but it is felt that they are necessary in view of the enormous investment in distribution lines. The following analysis is offered as a workable scheme for studying these systems.

Kelvin's law is usually understood as that principle which states that the greatest economy will result in purchasing a conducting circuit if the annual cost on the conductor is equal to the total value of the power wasted within it. It is recognized that the law is only approximate unless the cost of the conductor varies directly with its size. It seems, furthermore, to have been limited to those conductors for which the current is uniform for their entire length. It is understood that the total cost of the power wasted in a conductor includes both a demand and an operating cost.

The principle has been held as not applying to underground cable since the conductor cost does not vary directly as the conductor size. It has been held as not applying to secondary power mains since these carry indeterminate loads. Nor has any one apparently tried to apply the law to transformers, or the combination of lines and transformers.* The purpose of this article is to show how Kelvin's law can be modified so as to include all these cases. Four cases will be considered.

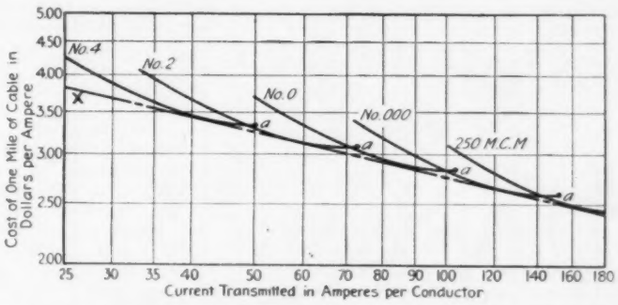


FIG. 1—ANNUAL COST OF CABLE IN DOLLARS PER AMPERE FOR VARIOUS CURRENTS TRANSMITTED AND FOR ONE MILE OF CABLE

Point (a) indicates lowest cost for a given size of wire. Curve X is ideal cost, assuming any size cable is obtainable. Example: For assumed cost data, what is the best cable size to transmit 100 amp.? From curves, No. 00 is best, but if this is not available, then No. 0 or No. 000 is equally good from a cost standpoint. No. 000, however, will be cooler and will allow for growth in load.

Case 1—Economical Size of Wire in Secondary Mains.—In a certain sense of the word, the currents in a secondary main are indeterminate. The residential customer often leaves his house in darkness and only occasionally uses his maximum demand. However, in the course of a year a fair average load can be estimated to the same degree of precision with which the transformer size or the drop in the line can be determined. Consider a somewhat ideal but average distribution, consisting of a 3-kva. transformer supplying a 600-ft. block with 24 amp. of current at 115 volts, a 4-amp. demand being assumed as taken from each pole except the end poles, where a 2-amp. demand is assumed. With 100-ft. spacing and No. 6 wire, the resistance per pole span is 0.08 ohm, including the resistance of two wires. The drop to the last customer is 1.44 volts, the same as if the 12-amp. demand of each half of the block had to flow to a point 150 ft. from the transformer. The power wasted in each half of the line is 12 watts, which is the same as if the 12-amp. demand of the half block had to flow a distance of 104 ft., or approximately one-third of the block.

Consider next a similar secondary main in which the current is tapered uniformly. The loss varies as the square of the current and has the shape of a parabola the average value of which is one-third its maximum. One is led therefore to the following statement extending Kelvin's law to this and similar applications:

In a secondary main or other conductor in which the current tapers off uniformly from one end to the other that conductor is most economical for which the annual value of the power wasted in the conductor is equal to the annual charges on the conductor, but the power wasted in the conductor is the same as if the demand current flowed in only one-third of the circuit. Stated somewhat differently, the economical voltage drop per 1,000 ft. for the demand current in a secondary main is greater than the economical drop in a similar conductor carrying uniform current in the ratio of the square root of 3, or 1.73.

Of the numerous formulas given in different texts for the application of Kelvin's law, one of the best is that given by Gear and Williams in their book "Electric Central Station Distribution Systems." They give as the economic drop in transmission lines, feeders and other conductors carrying uniform current:

$$IR = \sqrt{\frac{a}{b+c}} \text{ volts per 1,000 ft.} \quad (1)$$

Here a is the annual cost of the wire in dollars per 1,000 ft. per ohm, b is the demand cost of the power wasted in dollars per watt-year, c is the operating cost of the power wasted in the same units, I is the peak current in the circuit.

For secondary mains, primary mains and other conductors where the current is tapered the above formula should be modified to read:

$$IR = \sqrt{3}\sqrt{\frac{a}{b+c}} \text{ volts per 1,000 ft.} \quad (2)$$

Here the symbols mean the same as above, except that I is the current in that part of the main where it is a maximum.

EXAMPLE OF CALCULATIONS

A practical example may help to make the matter clearer. What is the economical drop in a three-wire, 230-volt secondary lighting main? Let it be assumed that the cost of a single wire per 1,000 ft. is:

$$\$2.00 + 0.09 \text{ (circ.mil/1,000)} \text{ per year} \quad (2a)$$

This formula is based on data in Reyneau and Seelye's "Economics of Electrical Distribution" and gives a value for a in equation (2) of $1.49 per 1,000 ft. per ohm (annual). The same authority gives data for the loss factor in such a circuit as 10 per cent. Gear and Williams give data which indicate that a kilowatt of loss in such a main ties up $200 worth of plant, and that power at the switchboard

*Some paragraphs by Reyneau and Seelye ("Economics of Electrical Distribution," pp. 146-151) perhaps come as near to the point of view of this paper as anything that the writer has seen. However, they do not point out cost ratios or claim that they have an extension of Kelvin's law. Moreover, their result leads to considerably greater line costs and transformer spacings in the smaller load densities.

worth 0.8 cent per kilowatt-hour is worth 1 cent at the secondary main.† On the basis of these data the factors b and c are: $b = 0.024$, $c = 0.0088$. The economic drop is thus:

$$IR = \sqrt{3}\sqrt{\frac{1.48}{0.024 + 0.088}} =$$

11.6 volts per 1,000 ft. (3)

$$\text{Circ.mil} = 895I \qquad (4)$$

These drops and current densities are considerably higher than has been hitherto been thought economical for feeders, but even so the drop is by no means excessive; for if 2 per cent is the limit on a main, 198 ft. is permissible from transformer to load center, or 792 ft. for transformer spacings. Since Gear and Williams base the design of secondary mains on a 2 per cent drop in 600 ft., equation (3) indicates that in general a wire one size larger than their value will be economical.

It is of some interest to compute the cost of a secondary main per kilowatt of demand both for the ideal wire size and for stock wire sizes. Since 1 kw. of demand at 230 volts requires a maximum current in the main of 2.17 amp., or 1,950 circ.mils, a No. 6 wire can be most economically worked at 13.5 kw. demand. For powers greater than 13.5 kw. demand the annual cost of a secondary main, in dollars per kilowatt, is:

$$L = 1.053 + 6.00/\text{kw.} \qquad (5)$$

For loads smaller than 13.5 kw. where No. 6 wire is used, the cost is:

$$L = 0.0391 + 13.10/\text{kw.} \qquad (6)$$

In Fig. 2 is plotted the cost per kilowatt of different-sized lines at different transformer demands and per 1,000 ft. of line. The broken line represents equation (5), and the solid lines are for stock sizes of wire. It will be seen that little loss in economy results by keeping only even-numbered wires in stock. On the average a 2 per cent increase of cost will result. If every third wire size is kept in stock, the line cost will be increased 3.5 per cent on the average.

In Fig. 2 is also plotted the maximum transformer spacing at any load and wire size which will keep the drop within 2 per cent. In no case will 600 ft. give drops greater than 2 per cent, except with the two-wire system on loads in excess of 4.5 kw.

Some conclusions to be noted are: (1) Although loads in secondary mains are to some extent indeterminate, a fair approximation to their values may be had if it is assumed that the demand current flows in only one-third of the line. (2) The economic drop can be estimated from the usual Kelvin's law formula by introducing a correction factor of $\sqrt{3}$. (3) If secondary mains are designed for a 2 per cent drop, frequently a more economical wire size can be found which will give less drop.

†Electric Central Station Distribution Systems.

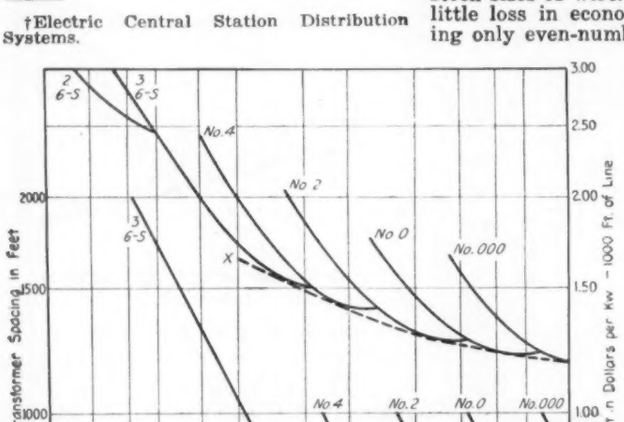


FIG. 2—ANNUAL COST OF 1,000 FT. OF SECONDARY MAIN AND TRANSFORMER SPACING FOR 2 PER CENT VOLTAGE DROP

Curve X is the ideal cost, assuming wire of any area. Example: For assumed cost data, what is the best wire size for distributing 40 kw. at 230 volts? From curves, it is seen that No. 1 wire is best, but if not in stock, curves show No. 2 to be better than No. 0.

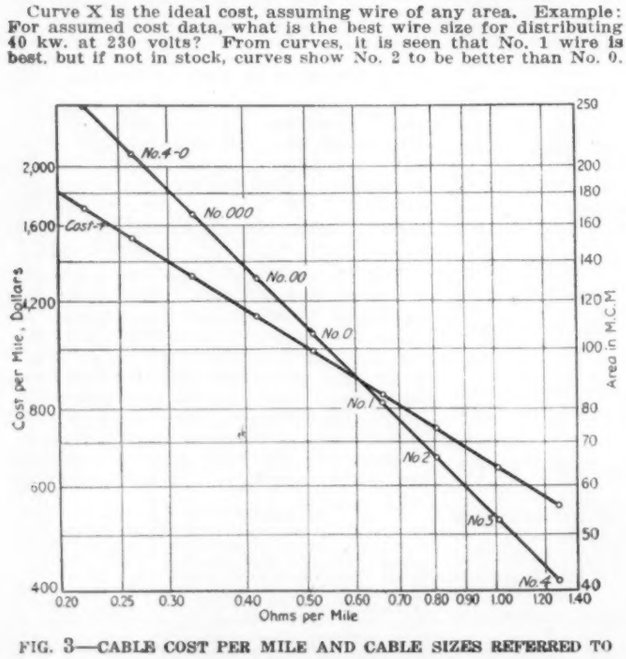


FIG. 3—CABLE COST PER MILE AND CABLE SIZES REFERRED TO RESISTANCE PER MILE

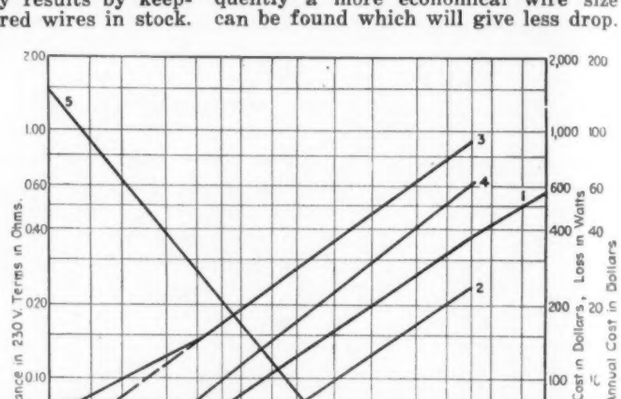


FIG. 4—ECONOMIC DATA ON TRANSFORMERS

(1) First cost; (2) iron loss; (3) annual fixed cost of transformer, including iron-loss cost; (4) copper-loss cost at full load; (5) resistance in terms of 230 volts.

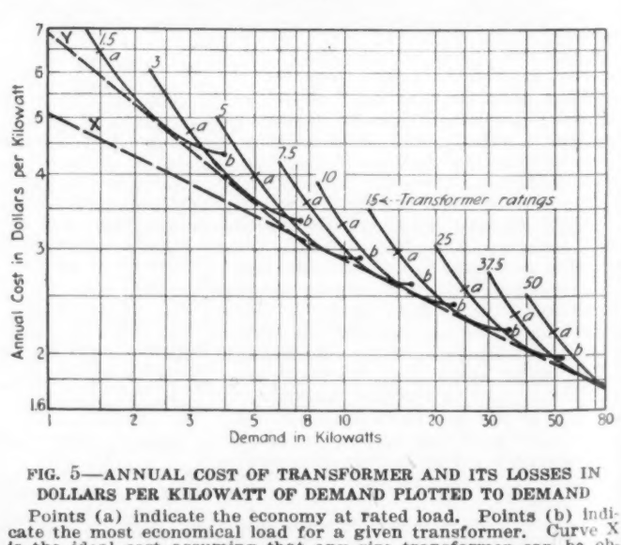


FIG. 5—ANNUAL COST OF TRANSFORMER AND ITS LOSSES IN DOLLARS PER KILOWATT OF DEMAND PLOTTED TO DEMAND

Points (a) indicate the economy at rated load. Points (b) indicate the most economical load for a given transformer. Curve X is the ideal cost assuming that any size transformer can be obtained with rating of 4 kw. and larger. Curve Y is the ideal cost for transformers below 4 kw. in rating. Example: From assumed cost data, what is the best transformer size to carry a 10-kw. demand? From curves, 5 kw. is best, but the 7.5-kw. size is nearly as cheap and will offer advantages in having a lower operating temperature and a greater overload capacity.

(4) Economy is an important factor in secondary main design, and, unless transformer spacings are over 600 ft., it is a more important factor than voltage drop.

Case II—Economical Size of Underground Feeders.—At first thought one would not expect a material error in applying Kelvin's law without modification to underground cable. However, if the cable cost in Gear and Williams is plotted on logarithmic cross-section paper, as in Fig. 3, it will be seen that a fairly straight line results, with a slope of 64 parts in 100, indicating that the cable cost varies as the inverse 0.64 power of the resistance. A 1-ohm cable costs $650 per mile per conductor, and at 15 per cent overhead it costs $97.50 annually. If it be assumed that 1 kw. loss at the peak load ties up $100 worth of plant, and that power wasted in the cable gives a loss factor of 20 per cent, we have for a the value 100 × 12 per cent/1,000 = 0.012. and for b the value 00.008 × 8,760 × 20 per cent/1,000, or 0.014. The annual cost of the cable per mile per conductor is:

$$Y = a/R^m + (b + c)I^2R = 97.5/R^{0.64} + 0.026I^2R. \quad (7)$$

This is a minimum when the derivative of Y with regard to R is zero.

Copper loss cost divided by cable cost = 64 per cent. (8)

Economical current = 80 per cent of theoretical value. (9)

By theoretical value is meant the economical current as computed by the unmodified Kelvin's law based on equality of costs, as is done in Gear and Williams. The rule for the economical cable size may be stated somewhat differently. The economical drop in volts per mile is:

$$IR = \sqrt{ma/(b + c)}/R^{(1-m)/2} = 49/R^{0.18}. \quad (10)$$

For No. 4 wire 51 volts per mile and 1,080 circ.mil per ampere are best. For No. 4-0 wire 55 volts per mile and 1,000 circ.mil per ampere are best.

The annual cost of a cable at its economic load in dollars per mile per conductor and per ampere transmitted is, on the basis of the above data:

$$Y = 7.64/I^{0.22}. \quad (11)$$

This cost is plotted in Fig. 1 as a broken line. If only even cable sizes are kept in stock, there will be a slight loss of economy. These costs are shown in Fig. 1 by the solid lines. The point of maximum dollar efficiency for a given cable size is marked by a point on each line. In each case there is another cable two sizes larger which is more economical for the same current.

Some conclusions to be noted are: (1) Kelvin's law can be extended to conductors where the cost varies as some power of the resistance other than the exact reciprocal. (2) The most economical cable for a given load is about 25 per cent, or one size larger than computed by the unmodified Kelvin's law. (3) In some cases a cable two sizes larger is more economical than the cable size computed by the unmodified Kelvin's law. (4) Cables chosen on the basis of equation (8) or (10) will heat only 64 per cent as much as when chosen by the unmodified Kelvin's law. (5) The economical cable is one in which the annual cost of the copper loss is 64 per cent of the annual cost of the cable.

Case III—Economical Size of Lighting Transformers.—At first thought the transformer that will most economically carry a given demand will be that rated at the demand value, or the next size larger, since it may be presumed that the manufacturing companies put out as efficient a transformer as is possible. But since the peak load on the average lighting transformer occurs in the winter, comes quickly to its maximum and lasts for a short time, it may well be that from the temperature point of view a transformer can carry an overload.

The question is not one of maximum efficiency for a given transformer, but of minimum annual cost for a given demand. Efficiency concerns losses only and not first cost. Minimum annual cost will involve a different cost per kilowatt-hour for both copper and iron losses. Nor is "dollar efficiency" quite the same thing, for, although there is a minimum annual cost for a given transformer, there will be always a larger transformer which, for the same load, will give lower annual cost.

The current prices for distributing transformers have been taken from the General Electric and Westinghouse catalogs, the prices averaged, and they are plotted in Fig. 4. The copper and core losses in watts, according to Gear and Williams, are also plotted. On the basis of 15 per cent interest and depreciation, a plant investment of $200 per kilowatt of demand, with 12 per cent interest and depreciation, a loss factor of 100 per cent, and a kilowatt-hour charge of 1.1 cents for the iron loss, curve 3 for the annual charges on a transformer is obtained. From the copper loss and the 230-volt rating curve 5, showing the resistance of the transformers in secondary terms, is computed. Between 4 kw. and 50 kw. rating these lines are straight on logarithmic cross-section paper, indicating that both transformer annual cost and transformer resistance vary as some power of the kilowatt rating.

The cost equation involves two terms, (1) the annual value of transformer fixed costs, and (2) the annual value of the transformer copper losses. This equation is:

$$T = \$5.05\ W^{0.73} + (b + c)I^2R, \quad (12)$$

where $R = 1.43/W^{1.21}$ ohms. (13)

It must be understood that R is the total resistance of both primary and secondary reduced to secondary terms. I is the peak current on the transformer. W is the transformer rating, to be distinguished from P, the transformer demand, which is $0.23I$. b and c are the demand and operating costs of the copper loss per year per watt. On the basis of the above cost data and a loss factor of 10 per cent, b = 200 × 10 per cent/1,000 = 0.024 and c = 0.01 × 8,760/1,000, or 0.0088.

$$T = aW^m + (b + c)I^2R_1/W^n = 5.05W^{0.73} + (0.0328)I^2(1.43)/W^{1.21}. \quad (14)$$

This cost is a minimum when the derivative of T with regard to W is zero, or when:

Value of copper loss divided by fixed cost = 0.73/1.21 = 60.5 per cent, (15)

$$\text{or } I/W = \sqrt{[ma/nR_1(b + c)]}\ W^{(m+n-2)/2} = 8.05/W^{0.03}, \quad (16)$$

$$\text{or } P/W = 0.23I/W = 1.852/W^{0.03}. \quad (17)$$

The following table can be computed from equation (17) and is useful as indicating the economical overload for different-size transformers:

Demand in kilowatts	8.85	17.30	33.80	82.50	101 00
Economical rating of transformer	5.00	10.00	20.00	50.00	100 00
Overload expressed in per cent	77	73	69	65	61

These overloads may not be permissible from the heating point of view, but if thermal indicators are used and transformers are not replaced by larger ratings until these indicators show loads near the temperature limit, higher economy will result.

In Fig. 5 is plotted the annual cost per kilowatt of demand, both for actual transformer sizes (solid lines) and for the ideal case of an infinitely fine gradation in size (broken lines). These curves show that if transformers are worked near their economic overload very little increase in cost is caused by using the infrequent transformer sizes. At the marked points (normal or rated load) an increased cost of 12 to 14 per cent is incurred. Even if only 25 per cent of overload is permitted, a considerable saving is secured, the cost being then only 3 to 4 per cent above the point of maximum economy. The lowest point on each curve is the point of maximum "dollar efficiency," and in each case the next larger transformer is more economical. The equations of the broken lines (ideal costs) show, in dollars per kilowatt demand below 4 kw.:

$$T = 6.90/P^{0.405} \quad (18)$$

and above 4 kw.:

$$T = 5.05/P^{0.25}. \quad (19)$$

Some conclusions to be noted are: (1) Kelvin's law can be extended to transformers only if both the cost and the resistance vary as some power of the rating. (2) The economical size of transformer for a given demand is that in which the annual cost of the copper loss is to the fixed cost inversely as the exponents of the powers with which these costs vary with the size. (3) Transformers are more economical when operated at a considerable overload. (4) An experimental study of the thermal capacity of standard lighting transformers and their temperature variation under artificially stimulated load curves would be of value.

Case IV—The Economical Transformer Spacing for Secondary Lighting Mains for a Given Load Density.—The combination of a transformer and a secondary lighting main has been held to present too complicated a case for the application of Kelvin's law. Speaking strictly, the cost involves four items—the annual fixed costs on the transformer and on the line and the annual copper losses on the transformer and the line. Three items of design must be chosen, namely, wire size, transformer overload and transformer spacing.

It would appear to be reasonable that an economical size of wire could be determined irrespective of the transformer and the economic overload of the transformer chosen irrespective of the wire size. If this assumption be granted, then the economical spacing is simply that which gives the most economical combination of transformer and line. In Case I, equations (5) and (6) expressions of line cost per kilowatt of demand have been worked out for 1,000 ft. In Case III, equation (19), an expression of transformer cost per kilowatt of demand has been worked out. These can be combined if we note that:

$$S = P/D, \quad (20)$$

where D is the density of load along

the main in kilowatts per 1,000 ft. of main, and S is the transformer spacing in thousands of feet.

Combining equations (20) and (19) with (5) or (6), the following expressions of total cost are obtained:

$$Y = 5.05/P^{0.25} + 1.053P/D + 6/D, \text{ when } P>13.5, \quad (21)$$

and $$Y = 5.05/P^{0.25} + 0.0392P/D + 13.1/D, \text{ when } P<13.5. \quad (22)$$

This cost is a minimum when the derivative with regard to P is zero. When the cost is a minimum the combined line costs are exactly one-fourth of the combined transformer costs, the demand being greater than 13.5 kw. Or, if No. 6 wire is used, the greatest economy is secured when the copper loss in the line is exactly one-eighth of the value of the combined transformer costs. If the annual value of the copper loss in the line is denoted by the symbol C, there results:

$$P>13.5,\ L/T = 1/4. \quad (23)$$

$$P<13.5,\ C/T = 1/8. \quad (24)$$

The equations for P or S may be solved in terms of D, or with the aid of equation (17) the value of W, the transformer rating, may be determined. Without recording here the mathematical transformations, the results may be given:

$$P>13.5,\ S = 1.155/(D)^{0.20};$$

$$W = 1.755(D)^{0.457};$$

$$Y = 6.076/D^{0.2} + 6/D, \quad (25)$$

$$P<13.5,\ S = 3.43/(D)^{0.55};$$

$$W = 1.755(D)^{0.457};$$

$$Y = 4.17/D^{0.111} + 13.1/D. \quad (26)$$

These results are plotted in Fig. (6), together with the per cent drop of voltage. It will be seen that the economical spacing gives a drop of less than 2 per cent for load densities greater than 5 kw. per 1,000 ft. No estimate has been made of the increased cost resulting from standardized transformer spacings. However, it may be safely asserted that if spacings of 400, 600, 800 and 1,200 ft. were used, few idle poles equipped for transformers would result. And as the load density grew transformers could be gradually spaced more closely and a higher economy maintained. Little increased cost should result from a transformer spacing 20 per cent greater or less than the ideal spacing.

Some conclusions to be noted are: (1) Kelvin's law can be extended to the combination of circuits, each following a different though exponential variation in cost. (2) A simple ratio holds between line and transformer costs for maximum economy. (3) The economical transformer spacing is not a constant, but varies from 400 ft. to 1,400 ft. as the load density decreases. (4) Economy gives a satisfactory design from the point of view of voltage drop when the load density is greater than 5 kw. per 1,000 ft.

In the section of the curve in Fig. 6 between 4 kw. and 6 kw. density per 1,000 ft. was obtained by considering the transformer size as constant and varying the spacing for a minimum cost. This was done because below 4 kw. transformers follow a different cost law and between 6.5 kw. and 7.5 kw. demand the 4-kw. transformer is more economical than sizes above or below.

It is not believed that the conclusions here stated will be greatly modified either because of standardized wire sizes, transformer sizes or transformer spacings, however, and a study of the effects of this combined standardization would carry the discussion far beyond the scope of the present paper.

GENERALIZED STATEMENT OF KELVIN'S LAW

If the total annual cost of a conductor, apparatus or combination is made up of two items, A and B, each of which is a function of some one design factor, X, be it resistance, kilowatt rating, circular mils or some other specification, in such a manner that (excepting constant terms) each varies as some power of the design constant X, one directly, the other inversely, then the total cost is a minimum when the cost of the factor varying directly with X is to the cost of the factor varying inversely with X as the inverse exponent is to the direct exponent.

Stated mathematically, the total cost, Y, is equal to $A + B$ where

$$A = A_o + aX^m;\ B = B_o + bX^{-n} \quad (27)$$

Differentiating Y for a minimum with regard to X, one gets:

$$(A - A_o)/(B - B_o) = n/m, \quad (28)$$

$$X = (nb/ma)^{[1/(m+n)]} \quad (29)$$

$$Y_{min} = A_o + B_o + (1 + m/n)(nb/ma)^{[m/(m+n)]} \quad (30)$$

Equation (28) is obtained by differentiating (27), equating the result to zero and multiplying by X. Equation (29) is obtained by multiplying equation (28) by X^n and solving for X. Equation (30) is obtained by combining equations (27) and (28) so as to eliminate B and then substituting the value for X from equation (29).

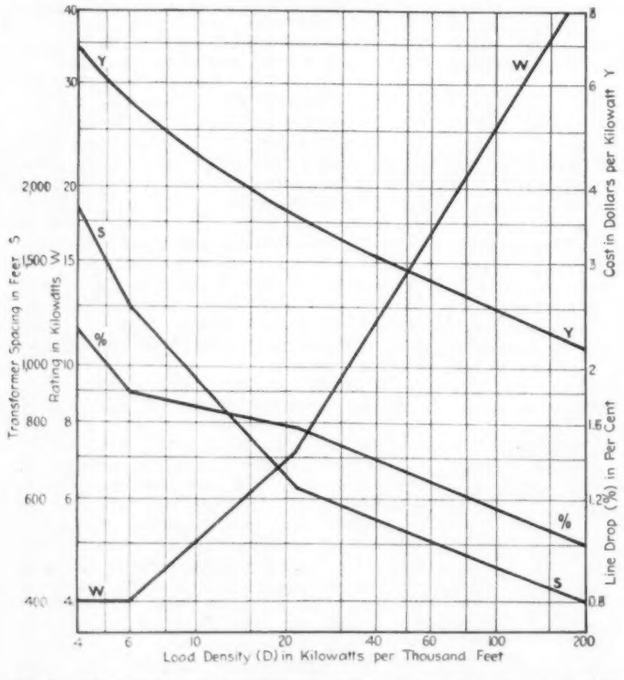


FIG. 6—ECONOMIC TRANSFORMER SIZE (W) AND SPACING (S) FOR VARIOUS LOAD DENSITIES (D) IN KILOWATT PER 1,000 FT.

Curve marked (o/o) is the drop on the line, curve marked (Y) is the annual cost in dollars per kilowatt of demand. Example: For assumed cost data, what is the economical transformer spacing for a load density of 40 kw. per 1,000 ft.? From curves, 550 ft. is given, which gives a drop of 1.4 per cent. If 400 ft. or 600 ft. is standard, it would be best to use 600 ft.

CONCLUSION

1. A number of circuits originally thought independent of Kelvin's law have been reduced to a form in which they become available for solution.

2. An expansion of the statement of Kelvin's law to a ratio between costs, instead of equality between costs, enables it to be applied to cases where costs vary according to some power other than the first or inverse first power.

3. In particular, larger cables and smaller transformers than indicated by previous standards have been shown to be economical for a given load. For secondary distribution larger wire and smaller spacings seem to be indicated as economical than, for example, those indicated in Gear and Williams "Distribution Systems."

4. The necessity of using certain standard sizes of wire, transformers and spacings reduces the economy, but, if these are all taken near the point of maximum economy, no serious increase in cost need be expected.

5. It is believed that this method could be applied to a number of other problems involving the economic selection of equipment with equally good results.

Servicing Domestic Electric Refrigerators

Experience Data for 224 Installations and Factors Involving Successful Promotion and Sales Methods as Reported to the Iowa Section of the N.E.L.A. at Fort Dodge

By H. E. YOUNG
Sales Manager Minneapolis General Electric Company

FROM the viewpoint of the central-station company the subject of domestic electric refrigeration covers just two points of vital interest: First, has domestic electric refrigerating equipment reached a stage in its development where its operation in the home is satisfactory, both from the standpoint of reliability and from the standpoint of cost to the consumer or dealer in the matter of upkeep? Second, what future can the industry look forward to for this equipment in the home which in turn will serve as a guide to its attitude in promoting the idea? There is only one way of answering these questions—by observation of the operation of a large number of machines over a period of years under all conditions of service.

Domestic refrigerating equipment has been on the market now for about twelve years. It would seem, therefore, that certain definite conclusions could be drawn. However, with the exception of the last two or three years, any conclusions which might be drawn from the past would be decidedly unfavorable. Numerous makes of equipment placed on the market during the past ten years have given unsatisfactory service, and continued experiences of this kind over a period of years have naturally resulted in many central-station men becoming skeptical.

Conclusive evidence is therefore now required to convince these men that domestic electric refrigeration has actually "arrived." Many are still inclined to speculate as to whether or not the equipment now on the market will ultimately meet the same fate as numerous predecessors. Although some dealers might be willing to risk pushing the equipment with such a possibility ahead, central-station companies would not be inclined to handle it if there was the least possibility of a repetition of such past experiences. The first thing that central-station men desire to know is whether there is anything about the present situation which warrants them in concluding that the refrigerator has come to stay.

PRESENT INDICATIONS

While it is not possible to say what difficulties may be encountered in future, there are some reasons to believe that we may today safely promote electric refrigeration. For instance:

One manufacturer of domestic electric refrigerating equipment has been in business continuously for ten years.

At least one maker of this apparatus—and possibly more—has had machines in operation in large numbers for five years.

Another company claims to have 20,000 successful machines in operation.

Still another reports 10,000 machines in actual use.

One city has over 4,500 machines in operation in homes. While no actual data have been collected as yet, there are said to be between 35,000 and 40,000 domestic electric refrigerating machines in successful operation in the United States.

At least one manufacturer of this equipment is on a dividend-paying basis.

Several other manufacturers claim an output varying from 500 to 1,500 machines a month.

Some central stations selling this equipment have had machines in operation under close observation, with accurate records of their performance, for periods as long as four years, and they are giving satisfactory service.

The matter of reliability and the cost of the maintenance and upkeep of this apparatus are subjects on which an increasing amount of reliable information is being continually obtained, all tending to prove conclusively that this is not going to be a serious obstacle.

To many central-station companies the foregoing statements may not be sufficiently conclusive to warrant their embarking upon a plan to pioneer and promote electric refrigeration. But the fact remains that this device offers the most attractive load-building possibilities of all appliances yet devised for use in the home. It is for this very immediate reason, therefore, that central-station companies are warranted in getting behind this proposal during the pioneering stages when such an attitude might not be warranted if it were simply a piece of electrical merchandise.

SERVICING DATA

The servicing of electrical refrigerators is a subject upon which many central-station managers have expressed doubts. But records show that with many machines in operation for four or five years the service requirements appear to be no greater than in the case of newer machines. Manufacturers in developing this equipment are making it possible at small expense to replace individual parts which may become worn after a period of years, without having to replace the larger and more expensive pieces of which these wearing pieces form a part. In other words, these machines have an almost unlimited life, even the replacement of wearing parts after a number of years involving only nominal expense.

As to service cost in maintenance and upkeep, only experience in the servicing of a large number of machines over a period of years can provide complete information. However, there are many mistaken ideas on servicing. It is sometimes thought that data on a certain number of machines showing the nature of the trouble and the time and material required to make the repairs will give a basis for arriving at such costs. Such information can at best serve only as a very poor guide. Service costs depend upon a number of other items which have a great deal more weight in fixing the ultimate expense. Among these things are:

1. Volume of servicing done.
2. Skill and dexterity with which men can be trained to do this work.
3. Experience and familiarity with service troubles.
4. Gradual education of the customer in looking after the equipment.
5. Education of the customer to expect to pay for legitimate repairs.

It is safe to say that almost any one of these items will have a great deal more bearing on the net cost of servicing this equipment than will the troubles developed by the machine itself considered on an individual basis.

PRECEDENTS FROM RANGE SERVICE

To illustrate from range experience, in a certain city during the early years of the sale of electric ranges the servicing ran as high as $10 per range per year. Naturally the central-station company entertained grave doubts as to whether this situation alone was not going to prohibit the electric cooking idea. Many manufacturers of electric ranges considered servicing the most serious problem to be confronted in the sale and operation of electric ranges. Nevertheless, in this very same city the cost of servicing all the electric ranges on the utility company's lines for 1923 amounted to only 90 cents per range per year. (See ELECTRICAL WORLD for July 26, 1924, page 176.)

The same results will hold true in a greater degree with domestic electric refrigerating apparatus, for the reason that the servicing will not include so many different factors. On account of the high demand of an electric range, there is liable to be low voltage; consequently voltage tests must frequently be made. If the voltage is found to be low, a study has to be made of the cause—whether there is transformer capacity in the immediate vicinity, the size of secondaries and so forth, or whether the trouble is due to too small wiring on the premises, in which case the wiring has to be investigated. These and other difficulties will never arise in the case of domestic electric refrigeration, and accordingly servicing can be more highly organized and simplified. The cost of service in the matter of maintenance and upkeep of electric refrigeration is, therefore, much more a local problem, to be worked out by each dealer handling the servicing, than a problem of reducing service troubles.

The accompanying table, showing some service data at present available, must be taken only for what it is worth. For it is only when the full volume of servicing has been rendered, and when this servicing has been organized to the fullest extent as regards all the items above mentioned, that it is possible to get at any actual figure as to its annual cost per machine per year.

OUTLOOK FOR SALES

Many data have been gathered to show that domestic refrigeration is good business to go after. Tables have been prepared showing that the annual revenue per kilowatt of demand is about double that derived from any other use of energy in the home and will amount to more than $100 per year per kilowatt, dependent, of course, upon the rate charged. Curves have been prepared showing how electric refrigeration tends to give a constant consumption of energy in the home every month in the year by reason of the fact that refrigeration is greater in the summer, when lighting is lower, and that refrigeration is less in winter, when the lighting load is on the increase.

As to the volume of business which the central stations may look forward to, we have merely to calculate what each utility company's increased revenue would be if $3 per month additional return were available from each of the residential customers.

There already exists a big field in introducing and pioneering domestic electric refrigeration. It is very important that the job be done right, that the machines be properly installed by an expert, that contact be kept immediately after their installation to check up on their operation, and that any troubles arising be attended to by an expert.

In other words, it is vital that the proper foundation be first laid if central-station companies are to expect a volume of business. At the present time in places where there is a large use of ice, such as restaurants, markets, the more pretentious residences and apartment houses, a decided saving can be shown for the refrigerating machines over the present cost of ice, even after taking into consideration the investment charges incident to the purchase of the machine. In the case of more moderate users of ice, of course, the saving cannot be compared with the cost of ice alone, but other advantages must be taken into consideration, such as increased convenience and less food spoilage. When these machines are manufactured in volume it is not improbable that there will be a reduction in the price, and the time may come when virtually every user of ice can save money by installing domestic electric refrigeration.

TABLE I—SERVICE CALLS FROM JANUARY 1 TO JUNE 1, 1924, FOR A GROUP OF 224 MACHINES

Thermostat			Belt		Expansion Valve			Idler Pulley		Compressor				Motor							
Adjusted	Repaired	Replaced	Loose	Replaced	Stuck	Adjusted	Repaired	Replaced	Loose Connection	Repaired	Replaced	Replaced	Stuck	Oil Machine	Defrosted Tank	New Fuses	New Brushes	Repaired	Replaced	New Bearings	Useless Calls	Oil	Repaired Tank	New Gas	Total
19	5	..	4	11	1	1	..	2	2	7	1	2	1	8	.	10	2	2	2	1	16	3	2	3	104

Total number of machines in service	224
Total number of customers reporting trouble, Jan. 1 to June 1, 1924	89
Total number of calls from customers, Jan. 1 to June 1, 1924	104
Total number of useless calls, Jan. 1 to June 1, 1924	16
Total number of calls where actual trouble existed	88
Average number of calls per machine in service during six months' period	0.465
Average number of calls per machine per year	0.93
Average number of calls per machine per year where actual trouble existed	0.785

SALES METHODS

In pioneering a new idea of this kind a sale revolves around two distinct points—namely, an idea and an article. The prospective customer has to be convinced that electric refrigeration is a feasible proposal and then has to be persuaded to spend the necessary money to purchase the article. Thus at the outset central stations are confronted with quite a different problem than would be the case if they were selling the refrigerator only. For example, no one needs to be convinced that an automobile is a desirable thing to own. Almost every one wants an automobile, and the only thing that prevents most persons from having one is the price.

THE ADVERTISING PROBLEM

What does this fact mean in connection with the sales methods to be employed in selling a domestic electric refrigerating outfit? For one thing, it means that advertising presents an entirely different problem. The advertisements used for selling the various kinds of higher-priced electrical specialties emphasize special features, such as a special price, a special free trial offer, an especially small payment down and easy terms, a premium if the article is bought during the sale, and so forth. This advertising is designed to produce an increased volume of sales, and the inculcation of the idea is not involved. In advertising refrigerators the first objective must be to sell the idea of mechanical refrigeration.

In every community there are always a few good "prospects" to whom refrigerators can readily be sold. These are the first customers to gain, and then the friends and acquaintances, who will follow their lead as soon as it has been demonstrated that the purchasers are satisfied with domestic electric refrigeration. This much can be done without going to big expense in advertising and sales cost. After a number of well-known individuals have come to use the equipment, a circularization advertising campaign can be employed, using a select list of "prospects" and sending out a certain number of letters each day to a section of this list, following these up by telephone calls making appointments and using the installations already in operation for reference.

As the number of users is increased circularization methods can be expanded until finally the time will come when advertising can be made to pay for itself. However, it is questionable whether advertising will ever be profitable unless central stations are ready to sell this equipment on the installment plan. There is every reason to expect, indeed, that central stations as well as other dealers will soon be universally selling this equipment on that plan.

In fact, the picture one likes to look forward to is of the time when the price of electric refrigerators will be sufficiently low to permit a purchaser to obtain one of these machines on reasonable monthly payments and without cost; that is to say, his regular monthly expenditure for ice would take care of his purchase payments. When this time arrives every residential customer can be figured on as a user of electric refrigeration.

It is doubtful whether any energy-consuming device of anything like similar importance ever reached the state of development which domestic electric refrigeration has now reached and attracted so little interest on the part of the central station. If it has been able to reach its present state of development almost independent of central-station co-operation, it is safe to assume that with the vital interest which the central station is sure soon to take in its success, the combined

TABLE II—SERVICE DATA ON A GROUP OF SEVENTY DOMESTIC ELECTRIC REFRIGERATION MACHINES FOR THE YEAR 1923

Machine	Years in Service	Nature of Calls and Number of Each		Cost of Labor and Transportation at $1 per Man per Hour				Cost of Material		Total Cost of Labor and Material
1	1½	1-A		1-A	$1.00					
		2-G	1-R	2-G	2.00	1-R	$2.00			
		1-L	1-S	1-L	1.00	1-S	2.50	1-R	$2.60	$11.10
2	1¾	5-A	1-D	5-A	5.00	1-D	1.00			
		2-B	1-E	2-B	2.00	1-E	1.00			
		1-C	2-U	1-C	1.00	2-U	2.00	1-E	$1.50	$13.50
3	1¼	5-A		5-A	$5.00					
		1-P	1-R	1-P	1.00	1-R	$2.00	1-R	$8.60	$16.60
4	1½	1-A		1-A	$1.00					
		1-B	2-G	1-B	1.00	2-G	$2.00			
		1-D	1-R	1-D	1.00	1-R	2.00	1-R	$1.50	$8.50
5	3½	1-A		1-A	$1.00					
		1-B	1-U	1-B	1.00	1-U	$1.00			$3.00
6	1	1-A	1-I	1-A	$1.00	1-I	$1.00			
		1-B	2-R	1-B	1.00	2-R	2.00	1-E	$1.50	
		1-E	1-S	1-E	1.00	1-S	1.00	2-R	2.10	$10.60
7	1¾	1-D		1-D	$1.00			1-E	$1.50	
		1-E	1-R	1-E	1.00	1-R	$1.00	1-R	3.50	$8.00
8	1¼	1-C	....	1-C	$1.00	....	.....	....	.....	.....
		1-D	....	1-D	1.00	....	.....	....	.....	.....
		1-N	....	1-N	1.00	....	.....	....	.....	$3.00
9	2½	1-H	....	1-H	$1.00	....	.....	....	.....	$1.00
10	1	1-D	1-N	1-D	$1.00	1-N	$1.00	....	.....	$2.00
11	2½	1-A	....	1-A	1.00	....	.....	....	.....	$1.00
12	1¼	1-B	....	1-B	$1.00	....	.....	....	.....	$1.00
13	1½		1-L			1-L	$1.00			
		1-E	1-N	1-E	$1.00	1-N	1.00			
		3-I	3-R	3-I	3.00	3-R	3.00	1-Q	$1.40	
		1-Q	1-S	1-Q	1.00	1-S	2.00	3-R	4.50	$17.90
14	1½	1-J	3-U	1-J	$1.00	3-U	$3.00	1-J	$1.40	$5.40
15	1¼	1-D		1-D	$1.00					
		1-G	1-N	1-G	1.00	1-N	$1.00	....	.....	$3.00
16	1½	1-U	....	1-U	$1.00	....	.....	....	.....	$1.00
17	1¼	3-A		3-A	$3.00					
		3-C	1-N	3-C	3.00	1-N	$1.00			
		1-D	1-R	1-D	1.00	1-R	1.00			
		1-L	3-U	1-L	1.00	3-U	3.00	1-R	$3.60	$16.60
18	1¼	2-A	1-G	2-A	$2.00	1-G	$1.00	....	.....	
		1-D	1-P	1-D	1.00	1-P	1.00			$5.00
19	1½	3-A	1-B	3-A	$3.00	1-B	$1.00	1-B	$0.25	$4.25
20	1½	2-A		2-A	$2.00					
		1-D	2-G	1-D	1.00	2-G	$2.00	1-E	$1.50	
		1-E	2-I	1-E	1.00	2-I	2.00	2-I	$2.80	$12.30
21	3½	3-A		3-A	$3.00					
		1-B	1-E	1-B	1.00	1-E	$1.00	....	.....	
		1-C	1-G	1-C	1.00	1-G	1.00	1-E	$1.50	$8.50
22	3½	1-C	....	1-C	$1.00	....	.....	....	.....	$1.00
23	1¼	2-C	....	2-C	$2.00	....	.....	1-J	$1.40	
		1-J	1-R	1-J	1.00	1-R	$1.00	1-R	6.80	$12.20
24	2½	1-F	....	1-F	$1.00	....	.....	....	.....	$1.00
25	1½	1-B	1-R	1-B	$1.00	1-R	$1.00	1-R	$3.65	$5.65
26	3½	2-A	....	2-A	$2.00	....	.....	....	.....	$2.00
27	1¼	1-B		1-B	$1.00	....	.....	....	.....	.....
		1-C	1-N	1-C	1.00	1-N	$1.00			
		1-D	1-U	1-D	1.00	1-U	1.00			$5.00
28	2½	2-T	....	2-T	$2.00	....	.....	....	.....	$2.00
29	2½	1-K	....	1-L	$1.00	....	.....	....	.....	$1.00
30	1½	3-A	1-E	3-A	$3.00	1-E	$1.00			
		1-C	1-G	1-C	1.00	1-G	1.00	1-E	$1.50	
		1-D	1-J	1-D	1.00	1-J	1.00	1-J	1.40	$10.90
31	3½	1-E	....	1-E	$1.00	....	.....	1-E	$1.50	$2.50
32	1¼	1-R	....	1-R	$1.00	....	.....	....	.....	$1.00
33	2½	1-A	2-G	1-A	$1.00	2-G	$2.00			
		2-E	1-L	2-E	2.00	1-L	1.00	2-E	$3.00	$9.00
34	3½	1-M	2-U	1-M	$1.00	2-U	$2.00	1-M	$16.56	$19.56
35	1¼	2-A		2-A	$2.00					
		1-E	1-P	1-E	1.00	1-P	$1.00			
		1-G	1-U	1-G	1.00	1-U	1.00	1-E	$1.50	$7.50
36	1¾	1-E	1-G	1-E	$1.00	1-G	$1.00	1-E	$1.50	$3.50
37	1¾	1-A		1-A	$1.00					
		1-I	2-R	1-I	1.00	2-R	$2.00	2-R	$7.55	
		1-J	2-U	1-J	1.00	2-U	2.00	1-J	1.40	$15.95
38	1½	5-A		5-A	$5.00					
		1-C	1-G	1-C	$1.00	1-G	$1.00	1-C	$0.86	$7.86
39	1	3-A	1-R	3-A	$3.00	1-R	$1.00	1-R	$3.65	$7.65
40	1¾	1-A		1-A	$1.00	....	.....	....	.....	$1.00
41	1¾	1-A	1-B	1-A	$1.00	1-B	$1.00	....	.....	$2.00
42	3½	2-A		2-A	$2.00					
		2-B	1-J	2-B	2.00	1-J	$1.00	1-J	$1.40	
		1-I	2-U	1-I	1.00	2-U	2.00	1-I	1.10	$10.50
43	3½	1-D		1-D	$1.00					
		1-F	2-L	1-F	1.00	2-L	$2.00	....	.....	$4.00
44	1½	2-A	....	2-A	$2.00	....	.....	....	.....	$4.00
45	1½	1-U	....	1-U	$1.00	....	.....	....	.....	$1.00
46	1¾	5-A		5-A	$5.00					
		1-E	1-I	1-E	1.00	1-I	$1.00	1-E	$1.50	$8.50
47	1¼	1-D	1-E	1-D	$1.00	1-E	$1.00	1-E	$1.50	$3.50
48	1¾	1-E	2-R	1-E	$1.00	2-R	$2.00	1-E	$1.50	
								2-R	1.25	$5.75
49	1½	1-G	....	1-G	$1.00	....	.....	....	.....	$1.00
50	1¾	3-A		3-A	$3.00					
		1-B	1-D	1-B	1.00	1-D	$1.00	....	.....	$5.00
51	1	3-A	1-Q	3-A	$3.00	1-Q	$1.00	1-Q	$1.00	
		2-D	1-R	2-D	2.00	1-R	1.00	1-R	4.60	
		2-E	2-S	2-E	2.00	2-S	2.00	2-E	3.00	$19.60
52	1¼	1-D		1-D	$1.00					
		2-I	1-Q	2-I	2.00	1-O	$1.00	1-Q	$1.00	
		1-P	1-R	1-P	1.00	1-R	1.00	1-R	2.25	$9.25
53	3½	1-E		1-E	$1.00			1-E	$1.50	
		1-R	1-U	1-R	1.00	1-U	$1.00	1-R	4.70	$9.20
54	1½	1-A	1-R	1-A	$1.00	1-R	$1.00	1-R	$1.10	$3.10
55	1½	1-A		1-A	$1.00					
		1-D	1-G	1-D	1.00	1-G	$1.00	....	.....	$3.00
56	2	2-A	1-I	2-A	$2.00	1-I	$1.00	1-I	$1.40	$4.40
57	1¼	1-A		1-A	$1.00					
		1-C	1-E	1-C	1.00	1-E	$1.00	....	.....	$3.00
58	1½	1-D		1-D	$1.00					
		2-R	1-U	2-R	2.00	1-U	$1.00	2-R	$3.70	$7.70
59	1½	3-A	2-E	3-A	$3.00	2-E	$2.00			
		1-D	1-R	1-D	1.00	1-R	1.00	2-E	$3.00	$10.00
60	1½	1-A	....	1-A	$1.00	....	.....	....	.....	$1.00
61	1½	2-E		2-E	$2.00			2-E	$3.00	
		1-I	2-R	1-I	1.00	2-R	$2.00	1-I	1.60	
								2-R	8.65	$17.25
Totals*		256	calls†		$260.50				$139.77	$400.27

*Nine additional machines, no trouble calls. †The expenses on these 256 service calls must be considered as a local problem dependent upon the experience of service repair men and the degree to which the locality has been "sold" on electrical refrigeration.

Key to Kinds of Trouble

A—Thermostat adjusted
B—Thermostat repaired
C—Thermostat replaced
D—Belt loose
E—Belt replaced
F—Expansion valve stuck
G—Expansion valve adjusted
H—Expansion valve replaced
I—Idler pulley repaired
J—Idler pulley replaced
K—Loose connection
L—Compressor stuck
M—Compressor replaced
N—Oiled machine
O—Defrosted tank
P—New fuses
Q—New brushes (motor)
R—Motor repaired
S—Motor replaced
T—New bearings (motor)
U—Useless calls

efforts of manufacturers, dealers and central stations will result in the business reaching large proportions.

It is the duty of central-station companies to see that it does not get a false start—that it is not handicapped, as it has been in the past, by having poor and untried equipment placed on the market, improperly installed and improperly serviced, with the inevitable result of unsatisfactory operation. Domestic electric refrigeration has too promising a future to suffer any further setbacks for lack of proper co-operation on the part of the central station.

Decided Upward Trend in Business

PRODUCTION figures upon which the "ELECTRICAL WORLD Barometer of Business Conditions in the Electrical Industry" are based indicate that October witnessed the settling down of general business to a steady ordering of materials for maintenance purposes, with industrials placing such orders in better volume. The general feeling during October that business would respond more favorably after the election has been more than borne out by the increased activity during the past three weeks.

During October the electrical industry as a whole was operating at 4.5 per cent below the estimated normal. In September it was operating at 8.4 per cent below normal and in August at 11.4 per cent below normal, indicating therefore that the upward swing which started in July was continued through October. Sales during the month were reported by several companies as being good. Incomplete reports for November indicate that this increase in activities was maintained. The attitude of the buyer has now distinctly changed from one of hesitation and uncertainty to a definite decision to proceed with deferred improvements.

Electrical business conditions in New England during October were improving slowly, and the first part of November witnessed a further distinct improvement. In the New York district electrical business was spotty but improving, and reports for November emphasized the upward trend still further. Electrical business in the Southeast was at a standstill during October, but subsequent to the election the electrical trade has shown a steady improvement. Trade in the Middle Western States was stable during October, and the tone has improved since the election. On the Pacific Coast business was stable during October, with an appreciable improvement during November.

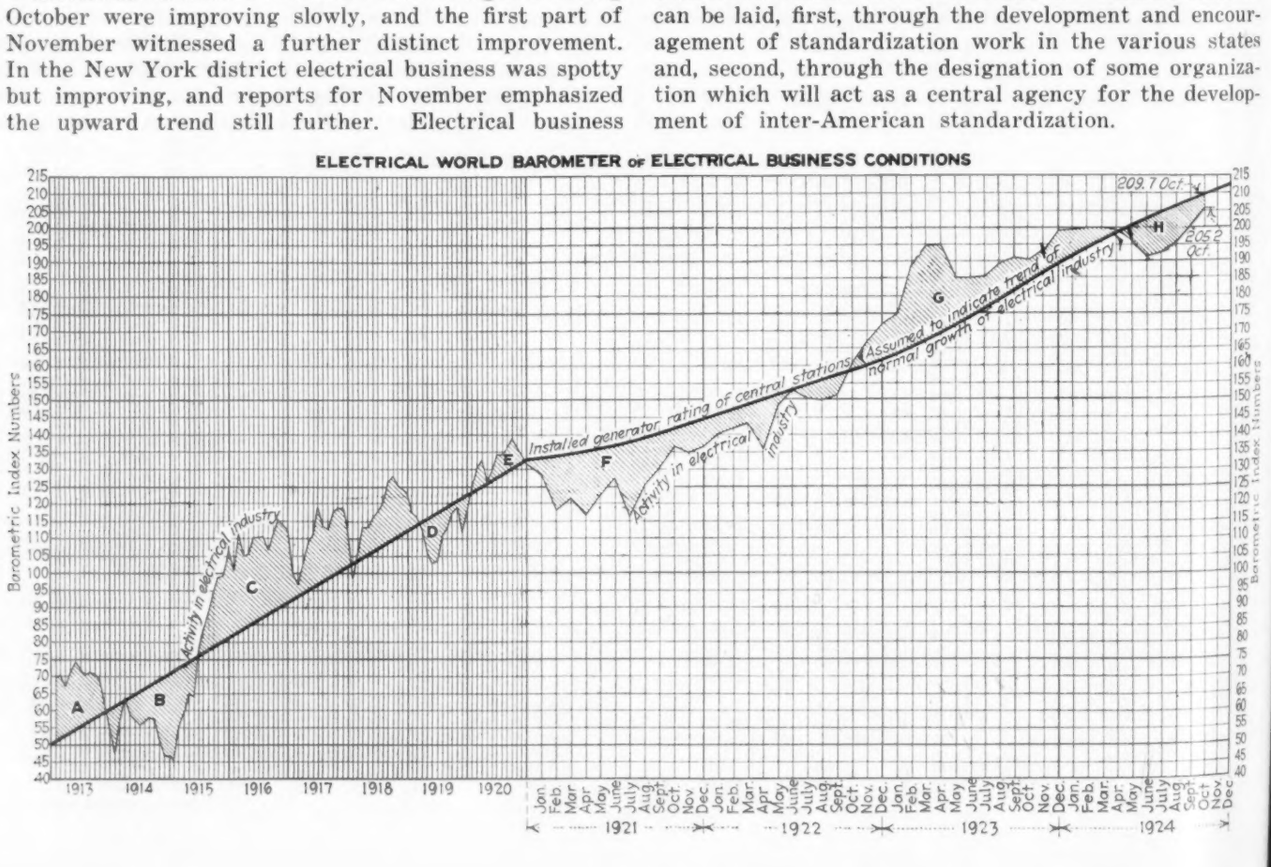
Incomplete reports indicate that during October the electric light and power branch of the industry was operating at 3.9 per cent above the estimated normal. The drought which so greatly curtailed the production of electrical energy in the hydro-electric plants of the Pacific Coast was relieved during October and there is now sufficient water to meet their requirements.

Pan-American Conference on Standardization

SIXTY technical and trade organizations in this country have been invited to send representatives to the conference on standardization to be held at Lima, Peru, beginning December 23, and there will be representatives of similar organizations from Latin-American countries, besides the official government delegates. The general purpose of this conference will be to study the possibilities of developing inter-American and international standards for raw and finished materials as well as standardized classifications and nomenclature. The Peruvian government has sought the co-operation of the Pan-American Union and the Inter-American High Commission in the development of plans and agenda. The American Engineering Standards Committee has assumed an important part in preparing for the work among the manufacturing industries.

No attempt will be made to adopt actual standards at this meeting, but it is confidently believed that a substantial basis for inter-American standardization can be laid, first, through the development and encouragement of standardization work in the various states and, second, through the designation of some organization which will act as a central agency for the development of inter-American standardization.

ELECTRICAL WORLD BAROMETER OF ELECTRICAL BUSINESS CONDITIONS



Central-Station Selling in Small Towns

Policies in Vogue on Twin State System Yield Annual Profits — Close Control of Stock, Sales Methods and Expenditures Essential—Merchandising Figures Presented

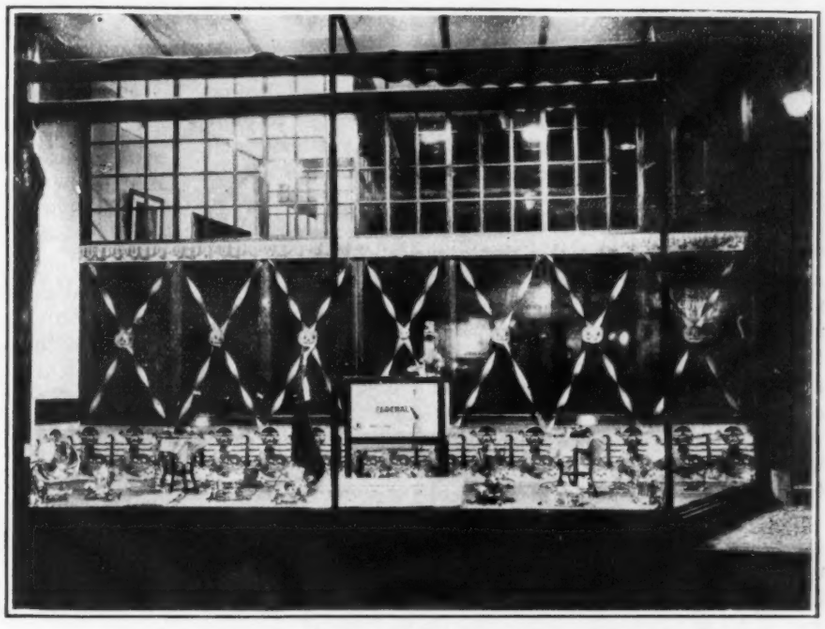
By EVERETT L. OLDS
General Sales Manager Twin State Gas & Electric Company, Boston

A DECIDED interest in the selling of electrical appliances has been manifested by central-station companies since the war, an interest also shared by manufacturers and jobbers. A ready market, hitherto undeveloped, has now assumed important proportions, and electric companies operating in towns averaging from two thousand to ten thousand population are developing this market intensively and successfully. Progressive central stations are organizing efficient merchandising departments in these smaller towns, and these are being conducted on a business basis. At the request of the ELECTRICAL WORLD some of the methods and results of merchandising by the Twin State Gas & Electric Company are outlined below.

This company serves a combined population of about 105,000 residing in eastern New York, Vermont and New Hampshire and is organized into the following territorial operating divisions: Bennington, Vt., and Hoosick Falls, N. Y.; Berlin, N. H.; Brattleboro, Vt.; Dover, N. H., and St. Johnsbury, Vt. There are about 21,000 residential customers on the system. The system properties are in general from 60 to 200 miles apart, and the executive offices are at Boston, each division being under the administration of a local manager. Public relations, financing, accounting and engineering are handled along co-ordinated lines, and sales policies are determined and directed from the headquarters office, including the purchasing of merchandise, the general supervision of sales forces and the budgeting of expenditures. In 1921 the gross appliance sales totaled $53,000. Last year the total sales amounted to $89,278 and the present rate of sales is $125,000 per year.

In this organization we attempt to meet the merchandising needs of a town of, say, ten thousand people as efficiently as though the work were to be done in a large city. This involves a well-appointed store, competent salespeople, established lines of electrical goods, energetic advertising and conservative use of money in carrying on the business.

We try to locate the stores advantageously and to provide each with a display window of sufficient size to show electrical goods adequately and prominently. Experience shows that if there is any one asset of the small-town electric shop, it is the display window. It is our practice to change window trims at least once a week and to keep windows alive at all times. An appalling number of sales are lost in this country through dealers' windows being allowed to be dingy and unattractive most of the time. There is little or no excuse for this, because the electrical societies, the manufacturers and the lamp companies provide window-trim suggestions free of charge. Naturally efforts are also constantly made by us to keep store and office interiors in good order, displaying appliances properly and also giving the store an air of merchandising efficiency.



TYPICAL SEASONAL (HALLOWE'EN) WINDOW DISPLAY OF THE TWIN STATE GAS & ELECTRIC COMPANY, BRATTLEBORO, VT.

The general sales manager uses his judgment in determining the size of the sales force in the towns served, but in general our experience indicates that one resident salesman for a town of ten thousand people works out best in the long run. This merchandise salesman should be a local man of good standing in his community, preferably a family man, one with enthusiasm and some originality, a steady man, but nevertheless a man who has to "hustle" for his own living. We try to make this resident salesman feel that we are setting him up in business for himself, and we believe in placing him in charge of the store and window, giving him responsibility and starting him off with a monthly sales bogey.

As to compensation, volumes have been written on this. There are a dozen different methods. Among

TABLE I—MERCHANDISING OPERATIONS, FEBRUARY, 1924

	Bennington and Hoosick Falls	Berlin	Brattleboro	Dover	St. Johnsbury	All Divisions
Gross sales (excluding lamps)	$1,485.69	$911.26	$1,324.46	$2,034.42	$876.85	$6,632.68
Gross cost (invoice plus 10 per cent)	1,121.55	637.45	1,064.44	1,500.40	581.20	4,905.04
Gross merchandising profit	$364.14	$273.81	$260.02	$534.02	$295.65	$1,727.64
Salesmen's bonus—commissions	$105.05	$24.00	$106.83	$80.24	53.88	$370.00
Overhead salaries	28.25	22.50	22.50	78.59	$22.50	174.34
Advertising	25.00	....	15.60	....	3.15	43.75
Traveling expense	85.28	16.00	12.08	0.80	52.04	166.20
Rent of offices	13.00	12.50	12.50	21.00	8.00	67.00
Printing and stationery	1.29	0.87	0.93	2.41	0.75	6.25
Miscellaneous	4.39†	7.02	2.23	99.81	13.61	118.28
Total selling expense	$253.48	$82.89	$172.67	$282.85	$153.93	$945.82
Merchandise gross net	$110.66	$190.92	$87.35	$251.17	$141.72	$781.82
10 per cent on investment (merchandise in stock)	66.61	42.78	27.22	107.84	48.64	293.09
Merchandise net*	$44.05	$148.14	$60.13	$143.33	$93.08	$488.73

*Salesmen's bonus based on this amount. †Deducted.

them are the straight salary, the straight commission, the salary and commission and the drawing account against commissions, etc. We believe that salesmen as a whole work best on a commission basis and obtain the best results when they can make the largest earnings from their sales efforts. The local salesman should work satisfactorily in the long run if he is given a drawing account advance against commissions. In the small towns a drawing account advance of $25 to $30 per week against a commission of 10 to 12 per cent has proved satisfactory. On this basis, he should be able not only to sell enough merchandise to equal his drawing account, but to make money over and above it. An extra commission to be figured at the end of each month on a certain volume of sales is also worked out further to stimulate the resident salesman. Every effort is made on the part of the company to see that the local salesman is properly compensated; we are not alarmed if he makes more money than other employees, for it is no easy job to canvass for sales, and if he is "bringing home the bacon," he is earning all the commissions he can get. Besides, the more he makes, the more the company makes.

Our experience shows that a local salesman should have a sales bogey. In this company the bogey is such that a salesman must "step lively" to make it. Our local salesman feels that he has an interest in the business, that he is the responsible party for the success of the electrical store.

SPECIAL CAMPAIGNS

Concerning special appliance campaigns and manufacturers' helps, it is apparent that one local salesman in a town of ten thousand cannot in the course of a year sell the entire volume of appliances to be absorbed by a community of this size. To assist the local salesman, therefore, stimulate the appliance business, put the local organization "on its toes" and build volume. We run at stated periods during the year, usually in the spring and fall, special campaigns on washers, cleaners, ranges, etc. The manufacturers, or their sales representatives, send several trained men to the town to assist the local salesman and enlarge the man power during these special drives.

We have not found this method too expensive for short, intensive drives, nor has it worked a hardship on the local salesman. The latter always finds that the after-campaign business, which is always very good, amply repays him for the business taken by the special salesmen. Besides, a special drive of this kind serves to get people thinking about the particular appliance handled by the central station. It is our belief, therefore, that where special campaigns of this kind are properly handled they form a valuable adjunct to the efforts of the local salesman.

A most important step in successful merchandising is a proper accounting for all expenses in connection with sales. These yardsticks or barometers are religiously kept and studied. The form of monthly report used is shown here, covering the operations of the St. Johnsbury division during February, 1924. This form is used on each division and totaled for all divisions every month, and for our own convenience we compare the estimated and actual revenues and expenditures and write in the increase or decrease above or under the estimate for the month and for the preceding year. Referring to the items listed, gross sales now include lamps, but these were not included in 1923; gross cost includes freight, handling and supplies; salesmen's commissions are figured at 10 per cent of the sales price; overhead salaries include the prorated salaries of the sales manager, division clerks, etc.; rent of offices is prorated on the basis of the area devoted to electrical merchandising; inventory shortage refers to losses; miscellaneous includes insurance on stock, and 10 per cent on investment on merchandise stocked is charged the sales department by the company for the use of its money. No credit is given for energy consumed by appliances, and the sales department is obliged to make a clear saving above its expenses on a purely merchandising basis.

Table I shows the actual results of merchandising during February, 1924, for each of the five operating divisions and the total for the company. It will be seen that this, one of the poorest months of the year in central-station appliance merchandising, showed a net profit of $488 after all costs were deducted and

TABLE II—MERCHANDISING OPERATIONS, JULY, 1924

	Bennington and Hoosick Falls	Berlin	Brattleboro	Dover	St. Johnsbury	All Divisions
Gross sales (excluding lamps)	$4,445.87	$675.52	$1,320.87	$3,238.70	$1,029.51	$10,710.47
Gross cost (invoice plus 10 per cent)	3,460.14	486.06	1,048.60	2,385.33	828.63	8,208.76
Gross merchandising profit	$985.73	$189.46	$272.27	$853.37	$200.88	$2,501.71
Salesmen's bonus—commissions	$335.57	$50.70	$76.79	$163.64	$64.88	$691.58
Overhead salaries	36.80	28.20	22.00	45.40	19.60	152.00
Advertising	5.37	20.80	....	122.66	24.61	173.44
Traveling expense	25.00	6.14	....	58.42	....	89.56
Rent of offices	13.00	12.50	12.50	21.00	8.00	67.00
Printing and stationery	....	2.00	....	....	....	2.00
Miscellaneous	81.34	27.20	70.56	54.94	14.88	248.92
Discount on purchase (Cr.)	3.47†	0.68†	3.97†	9.91†	0.68†	18.71†
Total selling expense	$493.61	$146.86	$177.88	$456.15	$131.29	$1,405.79
Merchandise gross net	$492.12	$42.60	$94.39	$397.22	$69.59	$1,095.92
10 per cent on investment (merchandise stock)	79.14	43.93	31.55	120.23	32.94	307.79
Merchandise net*	$412.98	$1.33‡	$62.84	$276.99	$36.65	$788.13

*Salesmen's bonus based on this amount. †Deducted. ‡Deficit.

$781 profit excluding the 10 per cent capital charge against the sales department by the company for the use of the money needed to carry on the appliance business. As gross sales amounted to $6,632, the final net profit represented 7.37 per cent of the sales revenue and the net profit excluding the 10 per cent charge for capital was 11.8 per cent of the sales revenue. Every division made a real profit after deducting all charges.

A normally good month's operations were those of July, 1924, and Table II shows the results of appliance sales in each division and for the company for that period. All but one of the divisions made a profit after all costs were deducted.

The results of the year 1923 appear in Table III for all divisions. The net profit, not including the deduction for use of capital, was $6,993, and after taking this out at the usual 10 per cent charge upon the department there remained $5,731 clear gain for the merchandising force.

This form of report has been used by us for about two years and is invaluable for our sales operations. Central-station executives will note that the form resembles an operating report. I contend that where a report of this kind is followed closely it will give a clear and accurate record of whether a merchandise department is actually standing on its own feet or not. All of the expenses shown in the form are, in the writer's opinion, correct and fair charges to be made against a merchandise department.

A few comments should be made in regard to company conditions and practices. We have six men engaged in sales work at present, or one per division, with the exception of Dover, where a district sales manager and an assistant are employed. Practically all sales work is done by canvassing and special campaigns. Probably not more than 10 per cent of the total sales come through the stores. At Christmas the stores are open two nights a week and the outside salesmen work in the stores. Normally the divisional clerks handle most of the sales in the stores. The average inventory value of stock carried in each of the five divisions is now about $5,000. We made a turnover of three in 1923.

We sell at list. The sales bogey for divisional salesmen is worked out on the basis of the departmental performance of the previous few years and with due consideration of a departmental budget annually prepared after analyzing the expenses and sales prospects

TABLE III—MERCHANDISING OPERATIONS, ALL DIVISIONS, YEAR 1923

Gross sales (excluding lamps)	$89,278.44
Gross cost (invoice plus 10 per cent)	66,661.72
Gross merchandising profit	$22,617.72
Salesmen's commissions	$9,810.35
Overhead salaries	1,924.55
Advertising	1,115.83
Traveling expense	1,193.37
Electricty and gas used	
Rent of offices	804.00
Inventory shortage	227.81
Bad accounts	120.73
Printing and stationery	70.20
Miscellaneous	1,019.48
Discount on purchase (Cr.)	*513.36
Total selling expense	$15,693.53
Merchandise gross net	$6,993.88
10 per cent on investment (merchandise in stock)	3,080.86
Merchandise net	$3,913.02
Plus profit on lamps	1,818.48
Total net profit	5,731.50

* Deducted.

MERCHANDISING DEPARTMENT

DIVISION ST. JOHNSBURY MONTH OF February 1924

	ESTIMATE	ACTUAL	INCREASE OR DECREASE EST.	INCREASE OR DECREASE LAST YEAR
GROSS SALES (Excluding Lamps)		876.85		
GROSS COST (Invoice Plus 10%)		581.20		
GROSS MDSE. PROFIT %		295.65		
Salesmen's Bonus—Commissions		55.88		
Overhead Salaries		22.50		
Advertising		5.15		
Travelling Expense		52.04		
Current and Gas Used				
Rent of Offices		8.00		
Inventory Shortage				
Bad Accounts				
Printing and Stationery		.75		
Miscellaneous		12.61		
Discount on Purchase (Cr.)				
TOTAL SELLING EXPENSE		158.93		
MERCHANDISE GROSS NET		141.72		
10% on Investment (Mdse. in Stock)		48.64		
MERCHANDISE NET*		93.08		
Plus Profit on Lamps				
TOTAL NET PROFIT				

Salesmen's bonus based on this amount

FORM OF MONTHLY REPORT USED BY EACH DIVISION

of each division. Appliance stocks are controlled by the managing staff at Boston with the aid of monthly inventories. The company aids in pioneering new devices by participation in their demonstration. Larger appliances are sold on the deferred-payment plan, with a year to complete the transaction. We have 400 electric ranges in service in the Berlin division alone, with a population of only 16,000. The average range installation has a wiring cost of $25 to $50 and yields about $5 or $6 per month in gross revenue per range customer.

We keep no central stock of appliances, maintaining local stocks only. The cost of appliance repairs is not a serious item with this company. A nominal charge is made for such work, and the total revenue from this source does not exceed $1,500 per year. Last year the company sold about five carloads of washers, two of vacuum cleaners, one of electric ranges and about 700 flatirons, besides many smaller devices.

By selling at list a good spirit is fostered among our competitors and we are pursuing a more businesslike method than would be the case if list were shaded. The "spread," or margin of profit, is largely looked after by our purchasing department, a plan of action that is to the advantage of the merchandisers. The purchasing department uses careful judgment in buying goods and seeks at all times to keep down the investment carried in each local office and to eliminate the hazard of carrying frozen stocks.

Our advertising in the local newspapers is consistent and constantly in use. About 1.5 per cent of the gross sales is appropriated for this purpose. This newspaper advertising is augmented by the use of broadsides for special campaigns, "fliers," "stuffers" sent out with local bills and other forms of publicity.

When electrical merchandise sales departments in the smaller towns are handled in the right way, if they are carefully watched, unnecessary expenses eliminated and fair and square merchandising methods used, it is the writer's opinion that they make a justifiable net profit and that it pays the central-station company to operate a merchandise department in the smaller towns on purely a net profit basis.

Tests on Electric Boilers

Liberation of Hydrogen in 5,000-Kw., 6,600-Volt Unit Found to Be Small and to Cause No Detrimental Action

BY C. DANTSIZEN* AND E. H. HORSTKOTTE†
General Electric Company

IN ORDER to determine the amount of hydrogen liberated in an electric-steam generator under actual operating conditions a test was recently made on a unit rated at 5,000 kw., three-phase, 60 cycles, 6,600 volts, and operating at 100 lb. gage pressure, installed at the plant of the Union Bag & Paper Corporation at Hudson Falls, N. Y.

The apparatus used in conducting this test was arranged as shown in the accompanying illustration. It consisted of a condenser which was connected to the main steam line by a ½-in. pipe. Cooling water was supplied to the condenser and the condensate was caught and measured in a graduated container. The gas was caught in an inverted glass graduate which served as a gasometer. Before the test was started the inverted graduate was so filled with boiled water that whatever gas was trapped at atmosphere pressure was equal in volume to the amount of water displaced. In order to make sure that no condensate from the main steam line drained back into the testing apparatus, the ½-in. steam pipe to the condenser was connected to the upper side of the steam line. It is a reasonable assumption that there is a homogeneous mixture of steam hydrogen and other gases at this point. Only a portion of the steam flowing in this line was condensed, the remainder exhausting to atmosphere. In this way only dry steam was taken into the condenser.

The first test was started at the time the generator came to normal operating pressure. During a period of sixty-two minutes 790 cu.cm. of gas was liberated from 5,010 cu.cm. of condensate. During this run the average power input into the generator was 1,450 kw. A gas analysis showed that there was 1.3 per cent of hydrogen present and 18 per cent of oxygen. Thus the 790 cu.cm. of gas or 5,010 cu.cm. of condensate contained 10.27 cu.cm. of hydrogen. Or, for each cubic foot (62½ lb.) of water evaporated, 0.00205 cu.ft. of hydrogen was liberated.

AN INPUT OF 1,450 KW. EVAPORATES 4,730 LB. OF WATER PER HOUR

During the tests the temperature of the feed water was 180 deg. F. and the pressure at which the generator operated was 100 lb. With these conditions the total heat added per pound of water evaporated, according to the steam tables, is 1,010.7 B.t.u. Assuming that the generator operates at 97 per cent efficiency, then the number of B.t.u. used per hour in evaporating water was 4,780,000. With an average input of 1,450 kw. a total of 4,730 lb. (76.5 cu.ft.) of water was evaporated per hour. Using the factor of 0.00205 cu.ft. of hydrogen liberated per cubic foot of water, the total hydrogen liberated per hour equaled 0.157 cu.ft. at this load, which is equivalent to 0.00131 cu.ft. per ampere per hour.

It will be seen from curve No. 1 that the rate of liberation of gas gradually decreases. This is to be expected, as there is a considerable volume of air in the generator shell and feed water which passes out with the steam during the first hour or so of operation.

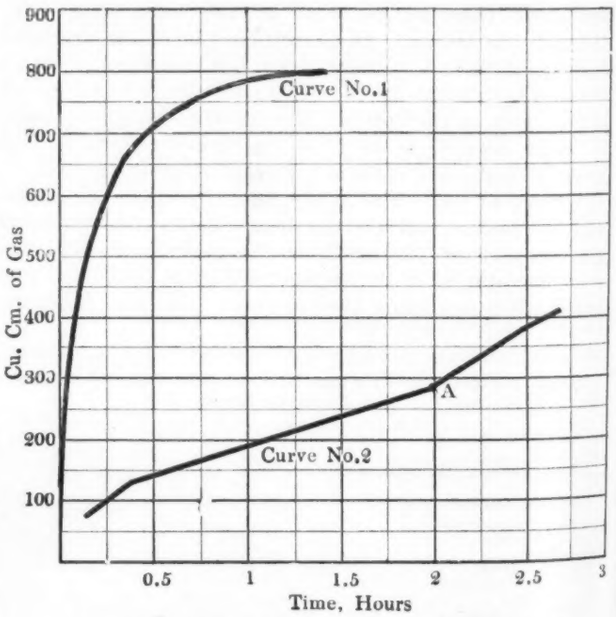
After the steam generator had been in operation several hours another test was made. During a period of two hours and forty-three minutes 407 cu.cm. of gas was liberated from 21,993 cu.cm. of condensate. During this run the average power input was 1,310 kw. The gas analysis in this case was: Hydrogen, 4.4 per cent; oxygen, 20.5 per cent. The 407 cu.cm. of gas or 21,993 cu.cm. of condensate contained 17.908 cu.cm. of hydrogen; or, for each cubic foot of water evaporated, 0.000815 cu.ft. of hydrogen was liberated.

PRODUCTION OF HYDROGEN GAS IS SMALL AND COMPARES FAVORABLY WITH FUEL-FIRED BOILERS

Calculating the number of cubic feet of water evaporated, a result of 69.8 cu.ft. of water evaporated per hour is obtained. This means that 0.05688 cu.ft. of hydrogen was liberated per hour when the generator was operating with a power input of 1,310 kw., and after the generator had been operating long enough to eliminate the effect of the air trapped in the generator while cold. This is equivalent to 0.000527 cu.ft. per ampere per hour.

Curve No. 2 indicates that the rate of evolution of the gaseous mixture is constant as long as conditions in the generator are constant. At the point *A* in this curve the feed-water regulator operated, admitting more water into the lower compartment. The rate of evolution of gas increased, owing to the presence of air in the added feed water. As soon as this air was removed from the generator the rate of evolution of gas was the same as before, as indicated by the slope of the curve.

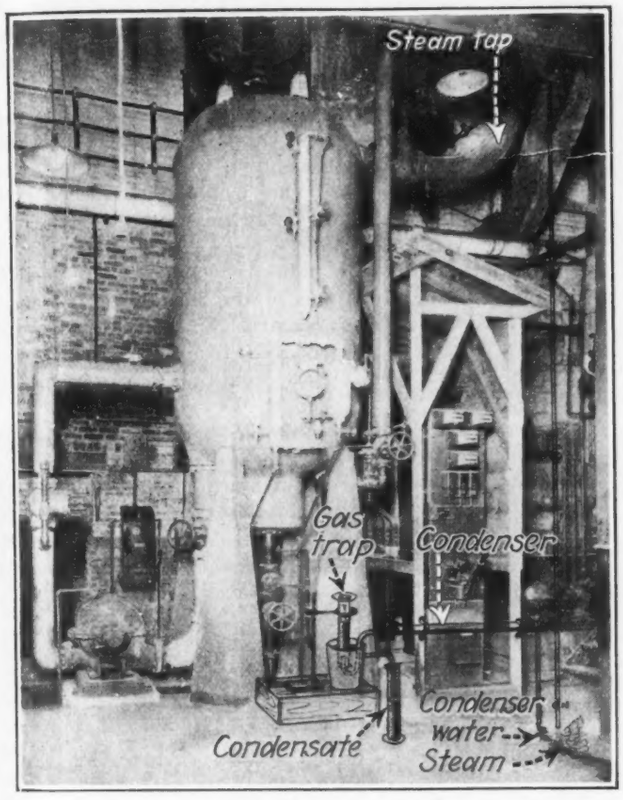
By comparison of the two tests it is seen that the evolution of gas (air and hydrogen) is greater when the generator is first started, and it is also seen that the evolution of hydrogen is greater when the generator is first put into operation than it is after running several hours. After conditions become constant the rate of generation is constant for a constant-current input.



RATE OF LIBERATION OF GASES IN ELECTRIC-STEAM GENERATORS BECOMES CONSTANT AFTER STARTING

*Research Laboratory.
†Industrial Engineering Department.

It should be noted that in either case the quantity of hydrogen liberated per hour is exceedingly low, and if the generator supplies steam to a circuit in which all condensate returns to an open hot well, it is impossible to accumulate sufficient hydrogen within the generator shell to form an explosive mixture of any magnitude. If the steam generator were operating on a closed system, however, evaporating the water over and over again, and no means were provided for the removal of the hydrogen generated, then a considerable accumulation of hydrogen would take place in the generator shell, which might be ignited by an arc drawn from the electrodes and exploded.



TEST EQUIPMENT FOR DETERMINING HYDROGEN GAS CONTENT IN ELECTRIC-STEAM BOILER

In order to determine if there is any greater hazard in operating a heating system with steam generated by an electric steam generator as compared with steam from a fuel-fired boiler, an analysis was made of the steam made in the boiler plant of the Schenectady works of the General Electric Company. Using the same apparatus, 160 cu.cm. of gas was trapped out of 50,000 cu.cm. of condensate. This gas analyzed 10 per cent hydrogen, which is formed by the action of steam in contact with iron. This is at the rate of 0.0003 cu.ft. of hydrogen for each cubic foot of water evaporated.

The generation of hydrogen in an electric steam boiler will be approximately proportional to the amperes input, but whatever the current input, the same volume of hydrogen might accumulate in a heating system if it were supplied with steam from a fuel-fired boiler, this being merely a question of time. However, since no destruction of heating systems has been attributed to hydrogen from fuel-fired boilers, it is reasonably safe to assume that the same performance might be expected with steam from an electric-steam generator.

Letters from Our Readers

The American Is Not a Tyro in Foreign Trade

To the Editors of the ELECTRICAL WORLD:

In your issue for November 15, on page 1036, you have an article entitled "The American in Foreign Trade" which relates what is declared to be a true story illustrating the attempt of an English manufacturer to get from a Chicago manufacturer a price on magnets.

So many of these isolated instances are related, and so many of the wonderful achievements of the American in foreign trade are never commented on in public, that I feel it my duty to say that while I have no inkling of the identity of either the British manufacturer or the Chicago manufacturer, I do wish to state emphatically, if the story is true, that neither was the Chicago manufacturer a typical representative of electrical exporting American manufacturers nor the English visitor a typical English manufacturer and importer.

In the first place, if the Chicago manufacturer had standing in the electrical industry, he would have an export manager who would not have talked so foolishly as you have indicated. The American exporting manufacturer and his export manager are the equal of any in the world. A typical English manufacturer would not have spoken as foolishly as did this Englishman. An English manufacturer of any standing at all would have figured his price in shillings within five minutes, and as to the freight rate from Chicago to New York or to Manchester, England, either party could have ascertained this by a telephone call (in Chicago) if this information was not available in the office where the conference took place.

I cannot close without calling attention to the book "Trade in the Balance" recently published by W. A. S. Hewins of London. This book by the greatest living expert in Great Britain on tariff questions states that the greatest foreign competitor with Great Britain in the markets of the British Empire is the United States. The American export manager knows his business.

JOS. MCELROY, 3D,
Export Sales Manager.
Export Department, Pass & Seymour, Inc.,
New York, N. Y.

Load Transference Again

To the Editors of the ELECTRICAL WORLD:

In the "Letters from Our Readers" column of the November 8 issue of the ELECTRICAL WORLD "St. Maurice" asks for a discussion of load transference. With no engineering experience backing my statements but with six years of practical operating experience with this and other companies, I can vouch for the following: In so far as I can find out the operators of this whole system of nearly twenty-four hydro-electric stations use the prime-mover method of load transference.

After reading "St. Maurice's" article I tried the method suggested by Weingreen and some others. The result was entirely unsatisfactory, and if it had been necessary to transfer the load quickly, as is sometimes the case, I am afraid the result would have been disastrous. I picked up a very high amperage, but only about 450 kw. where I should have taken on 2,500 kw. The power factor jumped from lead to lag, the direct-current regulator did not function as it should, and had

I relied on field excitation to transfer my load I should have been "out of luck" After being informed of the matter some of the other stations tried to change by this method and failed as well as myself.

Perhaps with one governor taking care of two or more turbines the method could be used to advantage. But I believe that where a number of stations are tied in and where each turbine is controlled by a separate governor the method would fail in general practice and would never be used where the prime-mover method can be used. At any rate I find it much more easy and practicable and very much more simple to change the speed of the prime mover. I also will be much interested in what others may have to say on the subject.

Oswegatchie, N. Y. W. R. DATOUSH.

A "Protective Association" of Engineers and Why It Is Thought Necessary

To the Editors of the ELECTRICAL WORLD:

In response to the questions submitted by W. M. Daniels of Milwaukee, I wish to inform him distinctly that in advocating the formation of a "protective association" among engineers I did not mean a union in the sense in which we understand a labor union at present. A union should be formed only after every reasonable and legitimate proposal toward constructive remedies has been brought to failure by plainly antagonistic interests. As a principle, I unhesitatingly believe in an open shop and free competition. Nevertheless, I am not blind to the fact that, owing to short-sighted and ruthless exploitation by unscrupulous employers in certain industries, men have been forced to form unions in self-defense. However, it will be a sad day when the engineering profession has to resort to such drastic means.

My idea of a protective association is one where the engineers would scientifically study and freely discuss the economic questions confronting them and force the attention of the controlling groups to them. Bankers have such associations; capitalists have them; manufacturers have them; most of the professions have them under different names. For example, the manufacturers' association I have in mind is not called a "union," but is known, I believe, under the name of "board of industrial relationship."

We must not confound adjectives with logic when speaking of "unions." Speaking in the vernacular, these various groups "stick together" for economic purposes. Even the reasoning of bricklayers makes them "stick together." But the engineers are conspicuous only because of the absence of an association of such nature among them.

If I were president of one of the leading engineering societies, I would strongly recommend and appoint a committee of unbiased men, absolutely free from all commercial interests and influences, to gather scientific data of the utmost reliability humanly possible. The task would be a huge one, and, allowing a margin of error, these data would be a fairly reliable indication of how many technical men have been graduated (going as far back as twenty-five to thirty years ago) from Class A, B and C colleges and also from the "get-wise-quick" institutions. It would show how many have dropped their profession, what their exact income was from year to year, the purchasing power of the dollar, their particular activities (in detail) and numerous other such data of vital importance. There should be a distinct discrimination between real engineering activties, those called technical, and skilled labor.

Since the excess of engineering graduates cannot be employed in real, actual engineering, they must find a living doing technical work of some sort not requiring the highest application of their training and experience. As a result they not only put themselves on a lower wage level, but also pull down the income of those doing real engineering work. The fact that most engineers are underpaid today is the most conclusive proof of this condition that I can conceive—all propaganda to the contrary notwithstanding!

As to the wisdom of a six-year course in engineering, there is no question in my mind about it. It is one of the first steps I recommend in gradually alleviating the very acute situation. One would not expect immediate results, but it would be an important move in the right direction. If there were fewer but better equipped graduates, the industry could absorb them to a better mutual advantage in the higher activities of the profession such as research and analytical work. In these fields the ill-prepared technical graduate or "get-wise-quick" technician could scarcely hope to compete.

Licensing of engineers should be made compulsory also for technicians engaged in responsible phases or details of the engineering profession. I will not ask the space to go into more detail at present, but may be the editors will allow us at some future time a little more elbow room in the front parlor of the ELECTRICAL WORLD.

New York City. GEORGE F. MARSTELLER.

Germany's Natural Power Resources

To the Editors of the ELECTRICAL WORLD:

I have been reading the article in the ELECTRICAL WORLD about "The World's Natural Power Resources" (September 13, 1924), and it occurred to me that some supplementary data might be of interest to you and your readers.

In the chart on page 513 the German power resources are recorded as follows: Potential water powers, 1,350,000 hp.; developed water power, 1,100,000 hp.; coal, 423,356,000,000 tons. The 1,100,000 hp. of developed water powers may be approximately exact; if anything, the figure is on the low side today. The potential water powers, however, considerably exceed 1,350,000 hp. The estimates of the last years vary from 2,000,000 hp. to about 5,000,000 hp. (according to different suppositions), 3,000,000 hp. being a good medium value. The coal lying within the actual boundaries of Germany and within 2,000 meters of the surface is estimated to be only slightly more than 300,000,000,000 tons.

As the index on page 511 (containing some states, like Esthonia and Hungary, with figures as small as 16,900 hp. and 2,900 hp.) does not include the much higher German figures, and as these are not discussed anywhere else in the article, it is possible that you may intend to give more details on Germany in a special article. If not, I suggest that you print the supplementary figures given above, as I think that, in comparison with the other figures, they will be of interest to a great many of your readers.

Dr. Ing. R. SCHUMACHER.

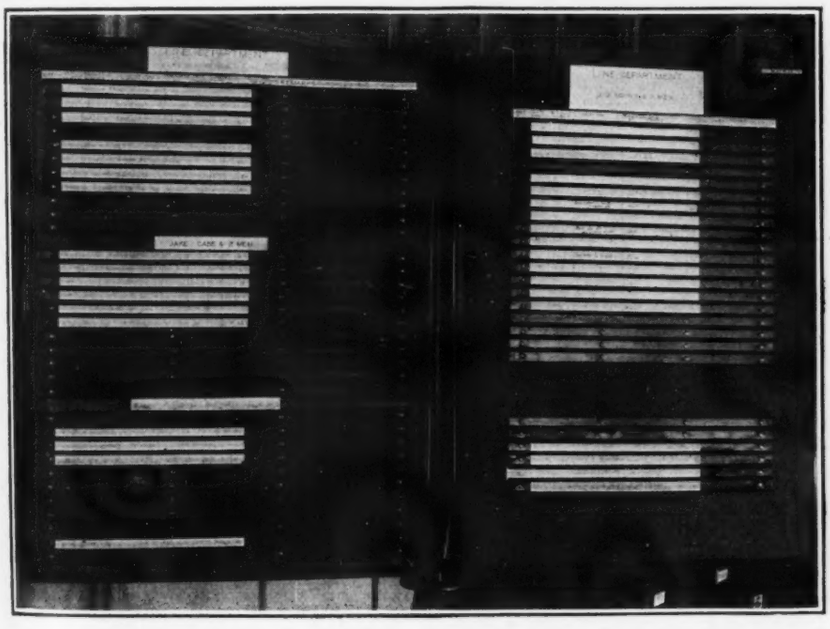
Allgemeine Elektricitäts-Gesellschaft,
Berlin, Germany.

Central Station and Industrial Practice

Systematic Scheduling of Construction Work

By R. A. Miller
Dayton Power & Light Company, Dayton, Ohio

REALIZING that service to customers can be greatly improved by systematic scheduling of all line and station construction work, the Dayton Power & Light Company has adopted a method which has worked to its entire satisfaction. Besides making it possible to control the cost of each job, it makes it possible to tell customers just when a certain piece of construction work will be completed and when service can be expected, which is a very important factor in maintaining the good will of the public.



FIXTURE USED BY DAYTON COMPANY IN SCHEDULING CONSTRUCTION WORK

The method employed to schedule work involves the use of a "multiplex" display fixture, which consists of several frames hinged on one common vertical axle, so that they can be turned like the leaves of a book. Along the top of each frame are headings indicating the date the work was issued, the date wanted, the work order or job order number, the person by whom requested, date the work was started, who requested changes and the date, the estimated man-hours required to complete the work, the man-hours devoted to the work as of any date, the estimated man-hours required to finish the work, and space for additional remarks. Below these headings are fifteen to twenty horizontal slides which accommodate strips of cardboard about 1 in. wide and ranging up to 20 in. in length, on which can be indicated the information referred to in the headings above. A horizontal slide is provided for each crew of workmen.

When a work order or job order is issued for construction work, a man who has acquainted himself closely with the ability of each gang determines to which one the work shall be given. This man was trained by having him work a short time with each gang employed. Through this experience and cost analyses he is able to determine which crew can do the work most economically. The job is then listed on one of the slides on the schedule board opposite the crew to which the work is assigned, and the order is kept in a file until the work is scheduled to begin. When a job is started and the order released to the crew, a small red card is inserted in the slide to the left of the cardboard strip referring to the particular job. Because of the conspicuousness of the red card, it is easy to tell at a glance which jobs are in progress and where the crews could be located in case of emergency.

As may be readily recognized, this system enables the supervisors of construction to ascertain very quickly the amount of work ahead in man-hours, so that it can be easily calculated how quickly any work can be completed if the force is increased, or whether other work can be substituted temporarily without delaying the prescribed finish date. It also enables the supervisor to ascertain what work is under way, how it is divided, etc. In general, this method of scheduling relieves the supervisor of construction of the detail work and gives him full time to devote to actual construction, thereby assuring more and better work.

Causes and Prevention of Boiler-Tube Failures

By J. W. MacKenzie
Operating Mechanical Engineer Consumers Power Company, Jackson, Mich.

PROBABLY the most frequent cause of boiler-tube failure is low water due to carelessness, to lack of adequate boiler-feed equipment or to failure to keep equipment in good operating condition. However, there is another cause which has not been so generally recognized, and that is the use of gate valves on boiler-feed lines. At one plant with which the writer was formerly connected seven tube failures occurred in one year, of which five were due to this cause. Even though a gate valve is provided with a rising stem it is impossible to tell the location of the valves by the position of the handwheel. Gates have been known to come loose from stems and the valves to remain closed when the stem has been brought into the open position. Two of the five failures were caused by this condition. The water tender had observed high water in the boiler and had closed the control valve, forcing the gates tight against the

seat. When he again attempted to open the valves the gates pulled loose from the stem, leaving the valve entirely closed while the stem came into the open position.

VENTURI METER WITH EVERY BOILER

It has become the regular practice of the Consumers Power Company to install a Venturi meter with every boiler. When used with centrifugal pumps and pure water, they give very accurate results, and in case of low water they indicate whether or not the water is being supplied to the boilers. Had Venturi meters been installed in the boiler feed in a plant where five boiler explosions occurred, the explosions would have been prevented. The expense thrown on the company by any two of the explosions would have justified the cost of the installation of the meters on all boilers.

Scale is another common cause of boiler-tube failures. This can be prevented by frequent use of air or water-power cleaners. The air cleaners are more economical where the plant is supplied with an air compressor of sufficient capacity, as they will operate more rapidly than a water-operated cleaner. This method of cleaning is very effective where a regular schedule is maintained to prevent undue accumulation of boiler scale. It necessitates, however, that the boilers be out of operation for a number of hours at frequent intervals. The work is often hot and tedious.

In virtually every case the proper use of soda ash or sodium silicate or lime and caustic soda or barium hydrate will produce better results than can be obtained with boiler compounds at anywhere from one-tenth to one-half the cost. In no case, however, should the treatment be carried on without competent, reliable tests being made for boiler alkalinity, free lime and amount of solids in solution. Some accurate check should also be made of boiler priming. Priming may be quite pronounced without material fluctuation of the water level in the gage glass.

BOILER-WATER TREATMENT

A very simple method of boiler-water treatment where the amount of sodium is low is by the use of a zeolite softener. This method has the disadvantage, however, that incrusting materials are changed into a soluble form and carried into the boiler instead of being thrown down in the treating equipment. Hence the boiler blowdown must be greater than with other methods of external feed-water treatment.

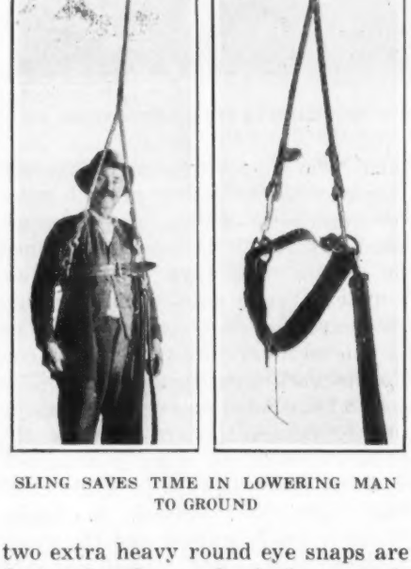
Evaporators provide a means of producing pure water for make-up purposes in limited quantities at a very reasonable cost and when properly installed and operated will keep the boilers almost entirely cleaned. There is no danger of priming or foaming and the blowdown can be almost entirely eliminated.

The presence of oil in boiler-feed water has frequently caused serious tube troubles. This is usually indicated by small blisters on the boiler tube, which are generally smaller in diameter than those due to scale trouble. The only real proof of oil or lack of it is to send a small sample of the scale to a chemical laboratory, where ether can be passed through it until all the oil has been dissolved, after which the ether is evaporated, leaving the oil.

Safety Belt for Removing Linemen from Poles

BY G. W. HURN
Manager Haverhill (Mass.) Electric Company

A SIMPLE device for removing an injured man safely from a pole was recently devised by Thomas Gammon, a foreman of our line department. It consists of 75 ft. or more of ½-in. rope and a safety belt provided with D rings into which



SLING SAVES TIME IN LOWERING MAN TO GROUND

two extra heavy round eye snaps are fastened. One end of the rope is spliced in the form of a Y as shown. One of these devices is carried on each line truck of this company, and while we have been fortunate enough not to have to use any of them thus far, there is no doubt that the method is a real time saver.

Substation Hazards Are Lowered

HIGH-TENSION operation constitutes the most frequent source of electrical hazards, declared Homer E. Niesz of the Commonwealth Edison Company when discussing safety rules for substation operation before the National Safety Council meeting at Louisville. This company has found that a specific training of employees as to what constitutes hazards has been of great value in lowering these hazards. Experience has shown that hazards in the operation of high-tension equipment fall under three classes:

1. Opening of disconnecting clips while oil switch is in series and under load.

2. Accidental contact on live line or bus terminals with test circuits or ground connectors.

3. Closing of hand-operated oil switches.

The opening of disconnecting clips under loads is usually the result of a failure to identify properly the switch before opening. It may be due also to the operator's failure to determine that the oil switch is closed. In determining the open or closed condition of oil switches the operators are instructed to place no confidence whatever in the indication of pilot lamps or the position of operating clips on oil switches. When training operators, strong emphasis is placed on the importance of thorough familiarity with the mechanism of each type of oil switch so that the operators may unfailingly recognize from the position of the switch mechanism its open or closed condition.

Some central-station companies have found certain devices helpful for indicating the position of oil switches, as signal lamps within disconnecting clip compartments, flags connected with the oil-switch mechanism and switch compartment doors that cannot be opened while oil circuit breaker is closed.

Accidental contact against live high-tension terminals is also frequently due to an operator's failure properly to identify the apparatus. This hazard is greatest where bare live high-tension conductors are in

close proximity to that portion of the apparatus which is dead for testing or grounding. Such conditions exist frequently in obsolete or poorly designed construction. In dealing with this hazard the safety rules require that all live conductors be killed before proceeding with the work. The hazard to the operator of applying ground connectors to live lines and buses has been greatly reduced where the grounding is done through the oil switch, and the final operation in grounding consists of closing the oil switch by remote control.

The closing of hand-operated oil switches is also a very serious hazard where there exists the possibility of closing the switch into a ground or short circuit. In the 12,000-volt industrial substations, where a number of hand-operated oil switches still exist, the closing of such switches is absolutely forbidden until the condition of the circuit is found to be safe. Rooms housing high-tension equipment are in themselves a serious menace to the safety of operators unless sufficient dimensions to avoid the crowding of equipment have been provided together with more than one exit in case of emergencies. Modern bus and switch compartment construction, clearly marked for identification, together with proper lighting and working room, have done much to lessen the hazards which are found to accompany high-tension switching operations.

Safety Equipment

Safety clothing and tools provided for all substations of the Commonwealth Edison Company consist of the following:

1. Electroscope, for detection of high voltages.
2. Insulated stool; heavy rubber mat where the stool cannot be used.
3. Leather gauntlets, used in place of rubber gloves on account of the danger of rubber being burned into the flesh.
4. Protective leather coats for all high-tension operations and for low-tension operations where heavy circuits must be broken.
5. Clip pullers, poles and tongs with insulated handles for opening disconnecting clips, switching and removing potential transformer fuses.
6. Gas masks are provided in substations where it may be necessary to enter rooms filled with smoke and gas from burning insulation.

Steel Draft-Tube Liners for Turbines

Thirty per Cent Saving Has Been Effected as Compared with the Cost of Wood Forms—Lined Tube Presents Better Wearing Surface

By E. A. Crellin
Assistant Engineer Pacific Gas & Electric Company, San Francisco, Cal.

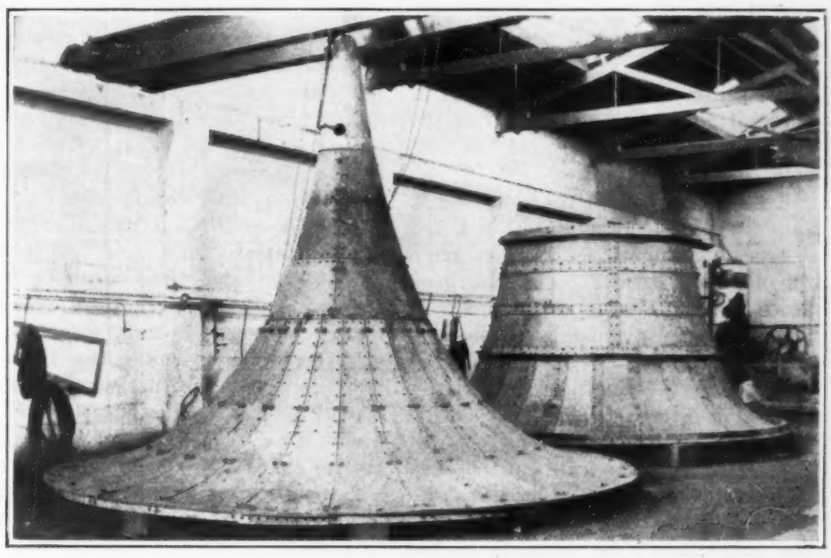
Draft-tube construction for a large modern hydraulic turbine presents a difficult problem and one which is costly of solution because of the expensive form work necessary where the usual reinforced-concrete construction is used. If the turbine efficiency guarantees are to be met, the contours as designed by the turbine manufacturer must be rigidly adhered to. The whole structure is one of large proportions, and the concrete form work must be securely braced to sustain the weight of the concrete when poured. The most expensive feature of such form work, however, is the large amount of hand work necessary to get the smooth stream-flow lines essential for efficient turbine operation.

In the construction of the draft tubes for the three 33,000-hp. turbines now being installed in the Pit River No. 3 power house of the Pacific Gas & Electric Company a large saving in construction cost was effected through the use of steel draft-tube liners. These units have the Moody spreading draft tube with the center cone and present a difficult piece of form work to construct of lumber.

The accompanying illustration shows the steel liners used in these units as they were assembled in the shops during fabrication and before shipping to the job. In the background may be seen the outside liner of the draft tube. The power-house foundations were poured to a point at the elevation of the floor of the draft tube. A table was then built and the outside liner assembled and riveted with countersunk rivets to give a smooth surface on the water side. Since the steel was built to the exact contours specified by the turbine builder, only rough shoring was necessary to insure against deformation during the pouring of the concrete.

As soon as the concrete was sufficiently aged to be self-supporting, the shoring and table were removed and the center cone was set in place and filled with concrete. By using these steel liners the expensive hand trimming of the wooden forms is unnecessary and the most costly part of the form work avoided. In addition, the steel presents a better wearing surface to the water than does the concrete.

These liners were constructed of ⅜-in. steel plate. The upper part of both cone and liner were conical where the flow lines were practically straight, and the lower part was made up of segments curved in one direction only, the number of segments being such as to make only a slight deviation from a true circle.



STEEL DRAFT-TUBE LINERS EFFECT SAVING ON PIT RIVER NO. 3 TURBINES

The inside cone is 20 ft. in diameter at the bottom and 10 ft. 8¾ in. high to the point of the attachment of the casting. The outer liner is 19 ft. 4 in. in diameter and 9 ft. 11 in. high.

The cost of wood forms in place, including stripping on each of two 40,000-hp. turbines previously built, was in the neighborhood of $10,000. The total cost of the steel liner and center cone for each of the three Pit River No. 3 units was about $3,500 delivered to the job. A large saving in construction cost was thus made, even if an additional $3,500 was spent in erection and shoring. Exact costs are not available at the present writing, but it is evident that a saving of at least 30 per cent was made and a better job insured.

Finishing Battery Charge Paramount

Control of Automatic Rate Should Be Made Entirely Automatic—Two Methods Prescribed—Dangers from Overcharging

IT IS the charging rate during the latter part of the charge which affects the life of storage batteries, declared W. E. Dunn, Electric Storage Battery Company, Chicago, recently. Unless close attention is given battery charging after the first hours of operation with high charging rates the best results will not be obtained. The attention can be in the form of manual control or automatic control. The latter is the only scheme which should be considered.

The discharged plates are heavily sulphated on the surface, and the degree of sulphation decreases from the surface inward. The charging process first breaks down the sulphate which is most accessible on the surface, so that as the charge progresses the sulphate which remains is less accessible to action from the outside of the plate.

A relatively high rate can be used effectively at the start of the charge, but as the charge progresses the rate should be reduced to the same degree that the sulphate becomes inaccessible and less in quantity. Should the high charging rate be continued, a point is reached where part of the current can do no useful work for charging the battery, so the excess energy breaks down the water into gas and generates heat. The higher the temperature the greater the unnecessary wear and tear. By breaking down of the water to its component elements, a process known as gassing, the bubbles of gas coming out of the plate and rising to the surface erode the active material from the surface of the plate if the action is violent as it is when too high a rate is used at a given point in the charge.

Therefore, in order to increase battery life and at the same time operate at the highest efficiency, a definite control of the charging rate throughout the charge is required. Such a system should be automatic, since the human element in determining the exact rate of charge advisable at a given time is too variable. Experience has shown that controlling the rate manually by determining the status of "gassing" is too uncertain since it is difficult to determine at just what period the "gassing" is such as to call for a reduction in the rate, according to Mr. Dunn. The safest and most economical way to charge the batteries fully and efficiently and at the same time to obtain the maximum life is by the use of automatic equipment, which, when properly designed, permits the battery itself to determine just what rate of charge it can employ usefully at a given time. With the proper automatic charging equipment the requirements can be met better than the operator can meet them by visual inspection.

AUTOMATIC CHARGING SYSTEMS

The fundamental scheme of the automatic charging system lies in the use of the variation of the battery voltage with the state of charge. This is an inherent characteristic. In general two schemes can be used. The first involves the use of an individual motor-generator set for each battery so designed that its current and voltage characteristics match the current and voltage characteristics required for charging the battery within a specified time, no adjustment of the field current being required during the charge. The same setting of the field rheostat is used regardless of the amount of discharge from the battery at the time it is put on charge. There are a number of concerns putting out such motor-generator apparatus as standard equipment.

Another scheme for obtaining the current control automatically is known as the modified constant-voltage system. It is an outgrowth of the old constant-voltage charging idea, which would charge the battery satisfactorily, but was impracticable on account of the very heavy copper connections required throughout the circuit, the high-capacity motor generator set and the high maximum demand, because of which the first cost and operating cost were high. The battery was charged in a very short time, but this was seldom an advantage. The present modified constant-voltage system reduces the initial rate to whatever current value is needed to meet the time requirements for the charge, so that if there is plenty of time the method can be used with a reduction in cost of equipment and a lower cost for energy on account of a better load factor.

This method uses a constant voltage of proper value on the charging bus with individual resistors in each battery circuit. A fixed value of the resistance is used regardless of the state of discharge. The rise in the battery voltage as it becomes charged reduces the available drop across the resistance unit, and thus less current can pass through, which results in a tapering rate as the charge progresses. Regardless of the time used for charging, the adjustment is always made such as to finish the charge at approximately the finishing rate for the particular battery.

Both of the schemes outlined eliminate manual control of the charging rate entirely.

The other feature which is essential to complete the automatic charging control is the cutting off of the charge at the proper point automatically. Mr. Dunn favored the use of an ampere-hour meter as the only practical device to accomplish the result. The installation of the proper ampere-hour meter is a good investment since it eliminates overcharging or undercharging of the battery, which improves its life and in the case of overcharging saves power enough in some cases to pay for the cost of the meter. In addition to these advantages, the method gives a direct reading of the amount of discharge in the ampere-hours taken out. Such a reading means more to the operator than a gravity reading. The cut-off point is de-

termined on the basis of a fixed percentage of overcharge.

Mr. Dunn emphasized the importance of installing the proper charging equipment at the very start so that the best results can be obtained from the battery as well as the driven apparatus as a whole. Unless batteries are properly charged, the truck or whatever the device may be which depends on the battery as a source of power cannot give the best service. A few "tow-ins" of street trucks, for example, go a long way toward discouraging the use of electric trucks.

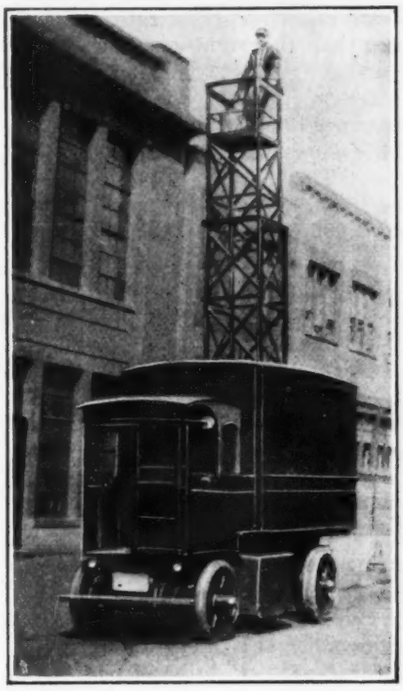
Automatic equipment properly designed is simpler in most cases than the improperly designed equipment which has been put out. From a standpoint of cost the automatic installation is less than that of the type of boards used for straight manual control. Actual practice has shown that there is no comparison in the result obtained, the automatic installation being better from every standpoint. Unless the battery functions properly and economically, the truck will not work in a manner to encourage purchase of additional equipment.

Tower Wagons for Street Lighting Service

FOR the replacing, repairing and cleaning of street lamps the Brooklyn Edison Company has recently acquired four tower wagons such as are shown in the accompanying illustrations. Another tower of the same design is used for painting poles. Engineers of the Brooklyn Edison Company had been working for a long time toward a truck of this type and finally by co-operating with J. R. McCardell & Company of Trenton, N. J., brought out the truck as shown.

The tower is in three sections, and when raised to its highest position the floor of the crows-nest is 21 ft. above the ground. When the tower is collapsed the over-all height of the vehicle is 11 ft. 8 in. The lower section of the tower, 30½ in. square and 6 ft. 5½ in. high, is made of structural-steel angles, while the middle and top sections are of wood. The latter are each 7 ft. 8½ in. high. The crows-nest is 26½ in. square and has a railing around it.

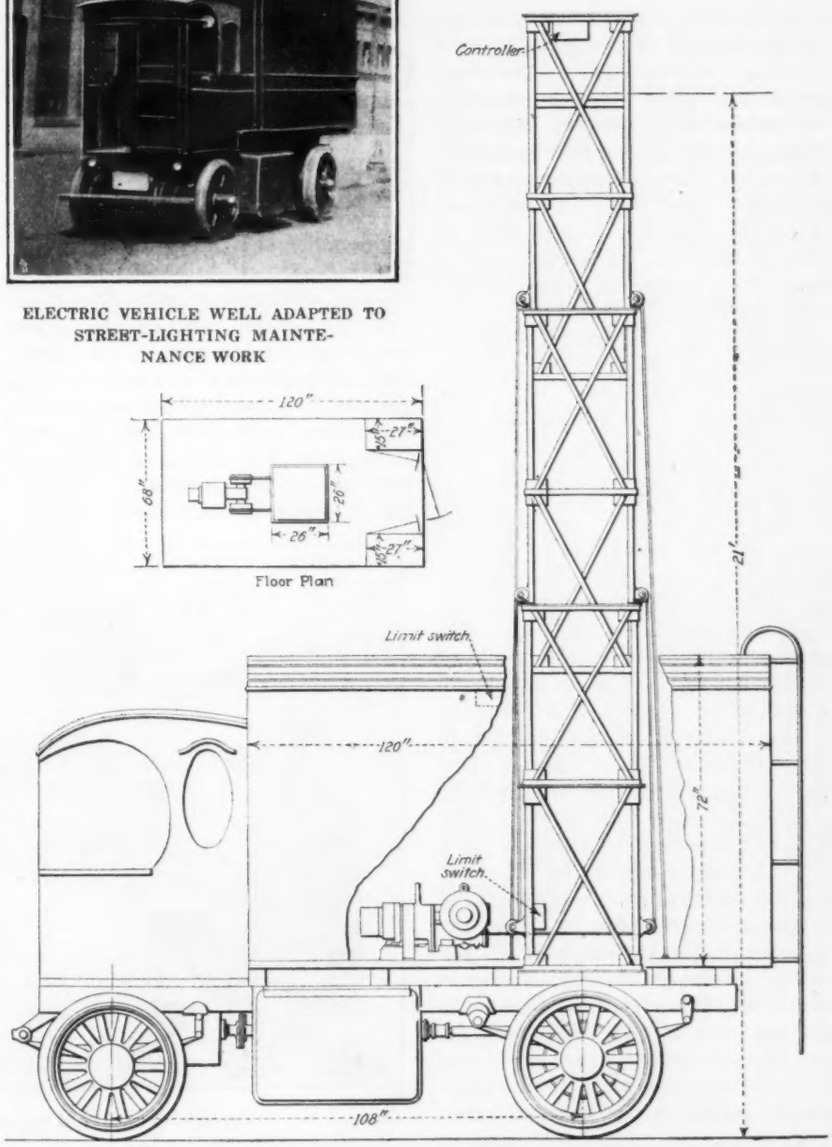
The tower is raised and lowered by means of a 1,000-lb. Sprague hoist driven by the truck's storage battery. The controller for the tower is in the crows-nest, the advantage of placing it here instead of in the truck being that the tower is less likely to be left in a raised position when moving from job to job. One limit switch is placed beneath the roof of the truck for the upward stop and another on the floor for the lowering stop.



ELECTRIC VEHICLE WELL ADAPTED TO STREET-LIGHTING MAINTENANCE WORK

The tower, body and cab are mounted on a 2-ton Ward electric chassis, model E-III. A special "Exide" ironclad battery of forty-five cells, each cell having seventeen plates, is used for driving the truck and for raising the tower. With a single charge the truck will cover 60 miles. An average of 40 miles a day is covered by this truck, which is in operation from 6 o'clock in the morning to 7 o'clock at night. A normal crew consists of two men—a chauffeur and a workman.

The initial cost of these trucks was approximately $5,000 each, but this includes the experimental and research work that had to be done. In the future this figure will be reduced considerably. So far the Brooklyn company has had excellent results from the use of these trucks.



ASSEMBLY OF TOWER WAGON FOR STREET-LIGHTING SERVICE

Central Station Business

Central Station Buys Steam from City Incinerator

STEAM in excess of requirements for working purposes that for years past has been discharged to the atmosphere by the garbage and refuse incineration plant of Atlanta is to be sold by the city to the Georgia Railway & Power Company under a contract to go into effect December 1 and to continue for ten years, with an indefinite extension in the future unless terminated by one side or the other.

It is expected that during the winter months the steam thus bought will be used in the commercial steam-heating system of the company named and that during the summer months the steam will be used at the commercial gas plant of the company. The contract requires very little outlay on the part of the city to deliver the steam to the operating plants of the company and not very much outlay on the part of the company to make connections, including the provision of a meter to measure the steam delivered.

The contract also provides for the amortization within ten years of the expense just mentioned on either side and for recompensing the city or company as the case may be for the outlay for the purpose indicated in case either of the two parties to the contract forfeits the contract within the ten years. It is thought that the city can deliver steam at the rate of 22,000 lb. per hour, a total of about 200,000,000 lb. a year; but the engineers representing the city thought it was not wise to undertake to deliver so much. The contract, therefore, provides that the city shall supply 80,000,000 lb. of steam a year, at an average of not less than 260,000 lb. in each twenty-four hours and at an hourly average of not less than 11,000 lb., the steam to be delivered at a minimum gage pressure of 170 lb., the pressure gage to be at the city's plant. A variation of 10 per cent in the hourly rate of delivery is permitted. The steam is to be delivered dry and of any reasonable degree of superheat. When the steam delivered contains more than 1½ per cent of moisture the company may discontinue its use until such time as dry steam is provided.

In case the city is unable to supply steam at the contract rate, the company has the right to make up the shortage from its own equipment and to charge the city not to exceed 20 cents per 1,000 lb. for whatever steam the company supplies for that purpose. The price to be paid the city for steam by the company is 16 cents per 1,000 lb. for the first 70,000,000 lb. a year and 20 cents for anything in excess of that amount, the payments to be made monthly. The contract provides for arbitration of differences between the two contracting parties that they cannot adjust otherwise.

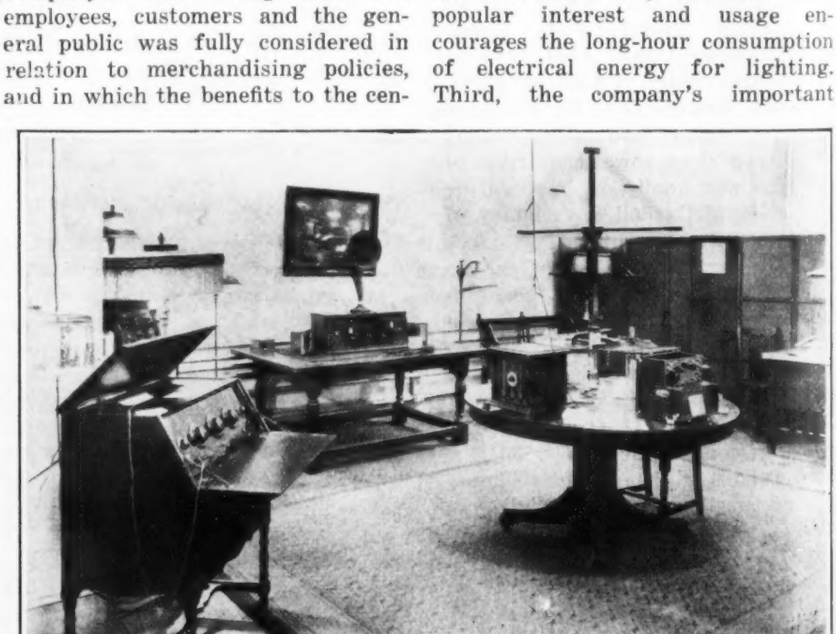
The foregoing information has been made available through the courtesy of W. H. Taylor, vice-president and general manager of the Georgia Railway & Power Company.

Why a Central Station Sells Radio

Boston Edison Adds New Department to Electric Shop—Widening Its Service to the Public the Company's Purpose in Capitalizing on Radio "Fan" Interest

COINCIDENTALLY with the inauguration of broadcasting from its new radio station "WEEI" early this fall, the Edison Electric Illuminating Company of Boston opened a radio shop in its appliance store at 39 Boylston Street for the sale of high-grade sets and major parts. The entrance of this company's appliance department into the radio apparatus field was decided upon after a careful study of the situation in which the development of the company's broadcasting service to employees, customers and the general public was fully considered in relation to merchandising policies, and in which the benefits to the central station from increased popularization of radio and to local communities from a merchandising "tie-in" received due attention.

There were four principal reasons for undertaking the sale of radio equipment in the Boston Edison electric shop. The first was the marked tendency among radio apparatus manufacturers to develop means for permitting the supply of energy to receiving sets to be taken from central-station convenience outlets. Second, the spread of radio in popular interest and usage encourages the long-hour consumption of electrical energy for lighting. Third, the company's important



CENTER OF BOSTON EDISON COMPANY'S RADIO SHOP

broadcasting station (a 500-watt installation built according to the most advanced practice in this field) deserved the support of the appliance department as another agency to aid in popularizing the programs. Fourth, there was an attractive profit to be realized in the sale of high-grade sets from the merchandising standpoint.

It was felt at Boston that the public is coming to look more and more to the central-station company for varied electrical services. The company felt it to be a logical move to begin to retail radio sets in order to supply complete facilities to its customers and to others interested, and it saw the wisdom of setting the stage, as it were, for future developments involving the use of central-station outlets for the operation of tube sets once the equipment reaches the expected plane of practical reliability and efficiency.

Radio as Load Builder

Even had the Boston company operated no broadcasting station of its own, there would still have been a strong incentive to undertake the sale of radio sets for the sake of increasing the lighting revenue. The varied and extensive programs offered to the radio listener by the company simply make the case for radio-set merchandising stronger.

The radio store occupies an attractive room on the second floor of the company's general office building, immediately above the main appliance shop and adjoining a section devoted to the display and sale of portable lamps. Every visitor to the second floor of the building passes the radio shop at close range. It was determined at the outset to avoid setting up a store that would carry a great variety of radio equipment and the usual enormous range of accessories. The store is run "on its own" with separate accounting, and is in charge of A. F. Folsom, a man of wide experience in the radio sales and installation field, reporting to C. Ernest Greenwood, superintendent of the appliance department.

The company's radio shop demonstrates sets, installs them on request and services them, but does not charge batteries. Two regular salesmen are now attached to assist Mr. Folsom and to handle outside demonstrations and servicing. The terms on sets sold by the radio shop are cash, or 25 per cent down, with the balance in deferred payments. It is considered desirable to try to close

Are You Ready?
WEEI, Edison Light, Boston's largest, finest, most powerful radio station goes on the air next Monday night. Watch the papers for the splendid opening program. Every night's program will be worth while, and you don't want to miss them. Get ready!
Tune in! But to get the program at its best, we suggest a Radiola
$35 to $425
Is the Price Range
Visit our new sales room on the second floor and pick out the Radiola that fits your home and purse. You may buy on convenient terms. Small first payment required. The service of a demonstrator is given free with every set purchased.
Come in now, and get ready for the opening of station WEEI.
We also carry a line of standard batteries, battery chargers, loud speakers and volt meters.
Radiola X
A rare combination of melodious reproduction, selectivity and range. Loud speaker operation up to 2000 miles under favorable conditions. Outdoor or indoor antenna.
The Friendly
Thirty-nine Boylston St.
The EDISON Shop

ANNOUNCEMENT OF BOSTON COMPANY'S ENTRANCE INTO THE RADIO BUSINESS

out the deferred-payment accounts in six months or less. The staff of the radio shop installs outdoor aërials on occasion, but this far not much of this has been required on account of the extensive use of loops in connection with the type of sets carried. The radio shop contains a very convenient and well-appointed service, and a test section has been set aside in a screened corner of the store.

Utility Companies Spend Little for Advertising

THE table given here, compiled by the Public Utilities Advertising Association, shows the advertising expenditures by different groups of utilities in 1923 and their estimated appropriations for 1924. The amount spent for advertising by each group when compared with its income is extremely small.

The gross revenue of central-station companies for 1923 was $1,300,000,000, not including the sales of appliances. The estimated investment in the industry is $5,800,000,000. But these companies spent only $3,000,000, less than one-quarter of 1 per cent of their gross annual revenue, in advertising to produce sales or to improve their position with their customers, who number 13,357,000.

These huge investment figures and, what is more to the point, the volume of annual business make the advertising expenditures, despite the increased appropriations of 25 and 50 per cent, look insignificant indeed.

Compared with the appropriations of from 1 per cent to 3 per cent of gross receipts which are normally set aside by successful merchants for advertising, the term "under-advertised" seems well applied to public utilities—particularly in view of what advertising has accomplished in this field.

Making Better "Prospects" Out of Window Shoppers

FREQUENTLY the purchasing appeals of central-station window displays are lost because the passers-by hesitate to enter the store to make further inquiry or perhaps purchase the article then and there. The Merchants' Heat & Light Company, Indianapolis, employs an effective method of impressing its window demonstration on the public. Two small galvanized-iron boxes have been mounted near the windows, and these are kept filled with circulars advertising the appliances displayed.

When the method of using an appliance is being shown in the window, the demonstrator, upon completing a cycle of the operation, points to one of the boxes, indicating that more detailed information may be found in the pamphlets. Many onlookers take a circular along with them to peruse at their leisure. By this means the value of these window displays is not lost to the company, and it is believed that many casual passers-by eventually become customers.

ADVERTISING EXPENDITURES BY UTILITIES, 1923-1924

Utility	Spent in 1923	Per Cent of Gross Income	Estimated Appropriation 1924	Increase	Per Cent Increase
Electric light and power	$3,000,000	0.0023	$4,500,000	$1,500,000	50
Electric railways	2,000,000	0.0020	2,500,000	500,000	25
Gas (manufactured and natural)	2,000,000	0.0047	2,500,000	500,000	25
Telephone	1,000,000	0.0013	1,500,000	500,000	50
Totals	$8,000,000	0.0023	$11,000,000	$3,000,000	37½

Steel-Melting Furnaces as a Steady Load

WITH the use of electricity for steel melting increasing each year, the electric steel furnace makes a very profitable and steady load for central stations. According to statistics compiled by the American Iron and Steel Institute, this growth has been very rapid since 1909, when 306 tons were first melted by electricity. Since that time the tonnage has increased until 235,958 tons were produced in 1923 and during all this time production from bessemer converters has fallen off.

In analyzing the reasons for this change-over many factors are presented, but the outstanding advantage of the electric furnace in operation is its ability to turn out a uniform product continuously, which is not always possible with other types of melting. Over a long period of time the quality of electrically melted steel can be held practically constant. Variable elements in the production of steel can best be controlled with electric operation.

A DESIRABLE LOAD

Considered from a central-station standpoint, this type of load has many advantages as a basic industrial load. A high demand coupled with a high energy consumption makes the steel-melting furnace an excellent unit to be connected to central-station lines.

The experience which the Michigan Steel Casting Company of Detroit has had with electric furnaces since 1915 is interesting and should prove valuable to central-station men in developing this type of load. This company up to 1915 had employed bessemer converters for melting medium-carbon foundry steel with a carbon content of 0.22 to 0.28 per cent. Since this steel was used largely for automobile parts, where quality was absolutely essential, the company installed an experimental 6-ton Héroult furnace in 1915, which was rated at 1,600 kw. The successful operation of this unit led to the installation of a 3-ton unit in 1916 and another in 1918 to take care of munitions work during the war.

With an average consumption during 1923 of 614 kw.-hr. per ton, H. A. Neel, manager of the Michigan Steel Company, has found that under normal production it is possible to pour twelve 3-ton heats every twenty-four hours from a single furnace, one pouring at 2,900 deg. F. At the present time the 6-ton furnace is operated only at a 3-ton capacity in order to hold the maximum demand down to 1,450 kw. The operating process calls for the first pouring between 7:30 and 8 a.m. and a pour every two hours thereafter. Under normal production these two furnaces require an energy consumption per month of between 400,000 kw.-hr. and 500,000 kw.-hr. Mr. Neel sees a growing tendency among steel-furnace men to use smaller units, thereby obtaining a higher number of pours per day. This is desirable in foundry practice because of greater facility in handling smaller quantities of metal.

The reasons for this steel company changing over from bessemer converters to electric furnaces, according to Mr. Neel, were that since their product was used in the automotive trade, a little finer grade of steel was required than could consistently be made under the former methods. Although the cost of operation might be a little greater than with converters, the saving in quality and in operating conditions more than offset this cost. An average of 24 lb. of electrodes per ton melted was used. Transformer capacity of 1,200 kw. for the 3-ton furnace and 1,600 kw. for the 6-ton furnace was provided through service of the Detroit Edison Company, stepping down from 4,600 volts to 120 volts. The operation of electric furnaces during the past nine years has been so successful that the Michigan Steel Company has not considered going back to the older methods of melting steel.

Customer Survey Makes Good "Prospect" List

SINCE a central-station company's customers make up the potential purchasers of electrical equipment, the Colorado Springs Light, Heat & Power Company recently adopted a system of card records whereby it is possible to tell exactly what appliances each residential consumer already owns and by simple elimination direct selling efforts on the other devices.

A set of cards, 4 in. x 6 in., was printed containing lists of the major appliances, and these were run through the addressograph list, so that there was one for each consumer. At the foot of the card was space for a question as to whether service was satisfactory or not. Salesmen then took the cards and made a house-to-house service survey, asking after the condition of the customer's equipment and noting on the card what appliances were already in use.

Later the list proved invaluable in preparing for the appliance campaigns which are the monthly feature with this company.

The cards were checked before each drive to eliminate the names of those already possessing the appliance in question, and the remainder were used as a mailing and telephone calling list to obtain further "prospects." Any further information obtained at this time as to appliances owned was noted on the card. At the end of each month purchases from the store itself are entered on the cards. The result is an invaluable mailing list of "live prospects."

Service Record

THE COLORADO SPRINGS LIGHT, HEAT & POWER CO.

E 238
MRS. M. A. HILL
WEST PILOT KNOB AVE.

OWNER

TENANT

ELECTRIC APPLIANCES	Condition Good	Bad	GAS APPLIANCES	Condition Good	Bad
Curling Iron			House Piped		
Dishwasher			Space Heater		
Fan			Hot Plate		
Grill			Range		
Heating Pad			Water Heater		
Iron			Laundry Stove		
Ironing Machine			Is Coke Used		
Percolator					
Sewing Machine			Gas Service Satisfactory?		
Space Heater			Electric Service Satisfactory		
Toaster					
Vacuum Cleaner					
Waffle Iron					
Washing Machine					

Date ..... 192 ..... Representative.

CARD SHOWING CUSTOMER'S APPLIANCES AND THOSE NOT ALREADY POSSESSED

Digest of Electrical Literature

Hydro-Electric Development and Steam Equipment

Saginaw River Steam Plant Costs Explained.—H. F. EDDY.—This article contains itemized cost figures for a 40,000-kw. plant, described in an earlier issue, costing only $71 per kilowatt of rated capacity. Explanations are given of local conditions and reasons for the design adopted, as well as a statement of difficulties encountered in getting the plant into normal operation.—*Power*, Oct. 14, 1924.

Turbo-Generators at Wembley. — MILES WALKER.—The author discusses current English practice in turbo-generator design and points out the conditions that have to be met. A chart showing the size of the largest generator supplied at various dates makes it evident that the tendency is still strongly upward. — *Electrician (England)*, Oct. 17, 1924.

Hydro-Electric Developments Near Campbellford, Canada.—Demand for power in the Central Ontario System has been so insistent that, even after putting in operation the plant at Ranney Falls, the Hydro-Electric Power Commission of Ontario decided to develop two sites on the Trent River at Dam No. 8 and Dam No. 9, near Campbellford, Ontario. Automatic remote supervisory control is an outstanding feature in each of these plants. At each development there are three units, those at Dam. No. 8 being rated at 2,000 kva. and those at Dam No. 9 at 1,400 kva.—*Canadian Engineer*, Oct. 28, 1924.

Generation, Control, Switching and Protection

Inexpensive Bus Layout.—V. WALTJEN.—The low-voltage buses in large power stations, carrying very heavy currents, require a great deal of copper, representing a considerable percentage of the cost of the installation. The article shows that the way in which generator connections and feeder connections to the buses are made influences greatly the required copper cross-sections of the buses. For every given number and capacity of generators and feeders can be found a certain bus layout calling for the least amouunt of copper. The author gives a very simple method for determining the proper size of copper to use.—*Siemens Zeitschrift*, September and October, 1924.

"Quarzilite" Resistances.—KUMMLER and MATTER.—By combining quartz and carbon according to a new process a resistance material can be obtained which lends itself readily to being shaped while in its plastic state into almost any desired form. The material is intended primarily as a protective resistance for current transformers, relays, radio receivers, telegraph and telephone apparatus, etc. Like all resistors made from a mixture of conductive and non-conductive parts, the resistance of "quarzilite" is in inverse proportion to the voltage. The relation is not linear, but approaches asymptotically a limit value with rising voltage. The size of the resistors required for any particular purpose can be determined mathematically, allowing a certain maximum heating. The material can be stressed as high as 60 watts per cubic centimeter for one second. A considerable increase of this value, even for only a correspondingly shorter time, is liable to cause arcing along the resistance rod.—*Bulletin de l'Association Suisse des Electriciens*, October. 1924.

Transmission, Substations and Distribution

Exact Calculations of the Voltage Distribution in Long-Distance Transmission Lines.—EDY VELANDER.—This paper gives a very comprehensive review of the problem of predetermining the voltage distribution in long transmission lines. The author shows that the mathematically exact solutions is a logical extension to the more thoroughly known theory for electrically "short" transmission lines. By making use of the available tables and diagrams on the types of hyperbolic functions which enter into the problem, the exact method is no more complicated than most of the numerous approximate methods in use.—*Teknisk Tidskrift (Sweden), Elektroteknik*, Oct. 4, 1924.

Manufacture of High-Voltage Insulators.—H. M. HUNT.—The author first points out that the resources of raw ceramic material on the Pacific Coast are being rapidly developed, so that it is now possible to obtain locally more than 50 per cent of the materials used in the manufacture of porcelain. The sources and properties of the chief of these—namely, ball clay, kaolin, feldspar and silica—are taken up and the details of the manufacture of insulators in a large Western plant are described. After firing, the insulators are inspected visually and then tested electrically by applying sufficient voltage to cause arcing over the surface. The arc is sustained for from five to ten minutes; faulty units break down and are eliminated. — *Chemical and Metallurgical Engineering*, Nov. 10, 1924.

Charleroi Substation of the West Penn Power Company. — GEORGE S. HUMPHREY. — The West Penn Power Company operates a distribution network comprising about 1.100 miles of circuit at 25 kv. in a highly developed industrial region serving an area of 10,000 square miles. Power is generated principally in four steam stations having an aggregate rating of 297,500 kw. and transmitted at 132 kv. The present article shows how the economic problems encountered in planning for the future were studied and gives a profusely illustrated description of the largest substation, rated at 60,000 kw. —*Electric Journal*, November, 1924.

Units, Measurements and Instruments

High-Voltage Insulators: An Accurate Method of Commercial Testing.—A. COLLINS.—The author points out that the one-minute test of insulators checks the axial clearances, but the factor of safety under operating conditions depends upon what has been called the "time-voltage" characteristic, which takes into account the effect of heating due to excessive local stresses. He describes a method depending upon measurements of temperature and of leakage, current and suitable particularly for checking the performance of new designs, which gives information regarding the condition of the insulator under long-continued application of potential. — *Electrician (England)*, Oct. 17, 1924.

Electromagnetic Moving-Coil-Type Oscillograph. — S. NUMAKURA. — The author has investigated the motion of the vibrator in the moving-coil type oscillograph, taking into consideration the presence of the mirror as a rigid body and also all physical properties of the strips holding the mirror. He has also formulated an equation for the motion of the oscillogrph.—*Research No. 135 of the Electrotechnical Laboratory, Tokyo, Japan.*

Testing Machine for Knife Switches. —O. EDELMANN.—The author describes an ingeniously designed testing machine to determine the mechanical qualities of knife switches, eliminating entirely the unaccountable variable of human irregularities. Essentially the device consists of two weighted pendulums, which are swung out, one at a time, by a motor and, after having been lifted to an adjustable extent, are released. The first pendulum, when swinging back, closes the switch, the second pendulum opens it again, and this process is automatically repeated until the switch fails. A number of details had to be worked out properly so as to imitate as closely as possible service conditions as they are actually encountered. — *Electrotechnische Zeitschrift*, Oct. 23, 1924.

Motors and Control

Small Motor Pump.—For cooling the oil from transformers or the lubricating oil from heavy bearings a motor-driven oil pump is required, to keep the oil in constant circulation. To reduce floor space and cost of such a pumping set, a Swiss concern has mechanically combined a small induction motor and a centrifugal pump. One of the end shields of the motor contains the stationary part of the pump in the shape of a spiral casing, and the impeller is placed next to the squirrel-cage armature. This arrangement obviates any kind of an oil-tight stuffing box between motor and pump. The stator and rotor of the motor are submerged in oil, and a part of the pumped oil is forced through the winding, providing thus such an excellent cooling that the motor becomes unusually small for its 4-kw.

output. At 10 lb. per square inch a volume of 132 gal. of oil can be delivered by the set.—*Bulletin Oerlikon*, October, 1924.

Electrification of Tata Iron Works at Jamshedpur, India.—S. GHOSH.—The steel which is manufactured by the above company is chiefly used in the making of rails, cars, buildings, bridges, etc., the total output being about 500,000 tons yearly. A very large quantity and variety of equipment is required to produce this tonnage. The management of the company quickly realized the advantages of electric drive. Some of these advantages are ease of control, increased safety, increased production and economy. As a result the electric drive has been applied to virtually all of the machinery used in the plant. The apparatus that is electrically driven is described.—*Iron and Steel Engineer*, October, 1924.

Starting Polyphase Synchronous Motors.—E. V. CLARK.—The author begins with the statement that a method commonly recommended for starting a synchronous motor is to run it up with the alternator. He suggests the use of an asynchronous alternator, the synchronous motor being given a turn by hand so as to supply an initial electromotive force, and asserts that a 150-kw. machine was successfully started in this way. Its inapplicability to factory conditions is admitted.—*Electrician (England)*, Nov. 7, 1924.

Heat Applications and Material Handling

Annealing of Brass Tubing in the Electric Furnace.—R. M. KEENEY.—Electric annealing of small brass tubing has proved to be more economical than annealing with wood fuel at the plant of the French Manufacturing Company, Waterbury, Conn. The brass is annealed in a 330-kw. electric furnace having inside muffle dimensions as follows: Length, 16, ft.; width, 4 ft. 6 in.; height, 18 in. The resistors, consisting of coils made of nickel-chromium alloy, are mounted in the walls, roof and floor. With power at 2.33 cents per kilowatt-hour and wood at $8 per cord, the power cost per ton of brass annealed exceeds the fuel cost by only 7.5 per cent. Yellow brass tubing in small sizes and thin gages can be annealed with a power consumption of 110 kw.-hr. per ton. of tubing, or 18.2 lb. per kilowatt hour. Lower labor costs due to greater rate of production, less time required for pickling because of much less oxidation of the brass, and no handling of wood, result in lower total costs for electric annealing.—*Paper presented before the American Electrochemical Society*, Detroit, Oct. 2-4, 1924.

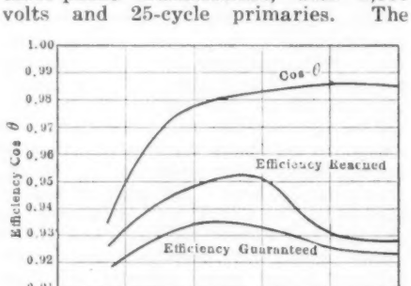
Electrophysics, Electrochemistry and Batteries

Magnetic Protection and Separation.—E. A. WILCOX.—To give the electrical industry a thorough understanding of the functions of the electromagnetic separator, the author has prepared this article, dealing with the four general classifications of magnetic separators. These four classes are (1) moving magnetic, (2) stationary magnetic, (3) induced magnetic and (4) belt-type magnetic. In the opinion of the author, there is a considerable load that might be developed by central stations if due attention were given to this class of industrial equipment.—*Journal of Electricity*, Nov. 1, 1924.

Insoluble Anodes for the Electrolysis of Brine.—C. G. FINK and L. C. PAN.—Anodic corrosion tests are presented for the alloys of the system silver-lead, and it is shown that the corrosion loss in brine drops very abruptly upon the addition of small percentages of silver to lead, or vice versa. The voltage curve is similar to the corrosion loss curve.—*Paper presented before the American Electrochemical Society, Detroit*, Oct. 2-4, 1924.

Traction

Mercury-Arc Rectifier Installation.—J. BARTHÉLÉMY.—For the supply of a section of the Parisian subway a 1,100-kw. substation has recently been put in operation which contains two 550-kw. Brown-Boveri mercury-arc rectifiers. They are supplied from two three-phase transformers, with 5,000 volts and 25-cycle primaries. The



PERFORMANCE OF MERCURY-ARC RECTIFIERS ON PARIS SUBWAY

transformers are connected Y primary and double-Y secondary to give six phases for the six anodes of the rectifiers. The two neutrals are connected to a special inductance coil the middle of which gives the negative pole of the direct-current circuit leading to the rails. A direct-indicating vacuum gage is installed for each unit, comprising contacts and relays for an automatic maintenance of the proper vacuum in the rectifiers. The entire substation operates without attendance and is remotely controlled from the nearest subway station, 600 yd. away. The entire equipment—transformers, rectifiers and all accessories—is installed in a niche along the track having a floor space of only 85 ft. x 11 ft. The overall efficiency of the apparatus at various loads is shown in the accompanying illustration.—*Revue Générale de l'Electricité*, Sept. 20, 1924.

Sixteen Years of Electric Locomotive Service at the St. Clair Tunnel.—H. L. KIRKER.—A brief account is given of operating results on the 3,300-volt, single-phase tunnel division of the Grand Trunk Railway. The electric locomotive mileage for the six 66-ton units has aggregated 3,300,000; gross ton-miles, exclusive of locomotives, 1,100,000,000, with less than one hour total delay chargeable to electric locomotives. These have been available for service 90 per cent of the time. Power consumption over the entire period at the switchboard has averaged 41.3 watts per ton-mile.—*Electric Journal*, October, 1924.

Telegraphy, Telephony, Radio and Signals

Design of Small High-Reactance Transformers.—R. H. CHADWICK and D. W. MARCHANT.—In small transformers for special purposes—e.g., supplying the filament current of a large radio transmitting tube—the necessary reactance can often be obtained more economically by the use of magnetic shunts than by the methods used in power transformers. A method of design based on this circumstance is described, with derivation of formulas and an illustrative example.—*General Electric Review*, October, 1924.

Experiments Confirming the New Theory of Long-Distance Radio Transmission.—G. W. O. HOWE.—In the issue of September 12 (see Digest, November 8) Prof. Howe dealt mathematically with a new theory of long-distance radio communication. In this article he deals with some experiments confirming that theory. The analysis involves primarily the determination of suitable values for two unknowns, namely the fraction, γ, of the radiated energy that is guided around the earth and the effective resistance r in ohms per square centimeter of earth's surface of the "transmission line" around the earth. Tables and curves show the effect of making various assumptions as to these quantities, from which, by comparison with observed signal strengths, the author finds that the day transmission curves correspond to a value of r of about 15 ohms, while the night curves require r to be about 20, the height of the Heaviside layer being taken as 100 km. The probable values of γ for the wave lengths used seem to be around 0.15.—*Electrician (England)*, Oct. 10, 1924.

Miscellaneous

Wind Power for Electric Farm Plants.—F. J. PANCRATZ.—The author reports the results of a series of tests made in the vicinity of Chicago on a 15-ft. windmill used in conjunction with a generator and a storage battery. The performance is analyzed aërodynamically to determine the best size and design for farm plants, so that charging will begin at a wind speed of 5 miles per hour and have its maximum rate for the given generator at all speeds above 11 miles or 12 miles per hour. He concludes that a 13-ft. wheel with a 32-volt, 12-amp. generator and 150-amp.-hr. battery will in general allow an average consumption throughout the day of 197 watts, or about 0.8 kw. for six hours, taking into account the longest observed periods of calm in the Middle West, and thus make cheap electric power available on farms that are not readily reached by distribution circuits.—*Mechanical Engineering*, November, 1924.

News of the Industry

Ford Hydro Plant Starts

Installation on Government Site at St. Paul May Help Railroad Electrification

OPERATIONS have begun at the Ford Motor Company's 18,000-hp. hydro-electric plant at St. Paul. This is the eighth and largest of the Ford water-power developments and completes a project undertaken by the government seven years ago. It is the second government power site developed by Ford interests, a similar project at Green Island, on Hudson River, near Troy, N. Y., having been completed three years ago. In both instances the plants pay a substantial rental to the government for use of the dams.

The plant at St. Paul was built to supply power for the Ford manufacturing plant now under construction. Until this is ready the energy is being distributed by the Northern States Power Company for lighting and power in St. Paul and Minneapolis. The dam is about the length of a city block, and there is a head of 34 ft. Locks have been constructed on the Minneapolis side for passing large river barges. There are four horizontal waterwheels rated at 4,500 hp. each. Water turbines are directly connected to electric generators of 60-cycle, three-phase, 13,200-kw. capacity.

Mr. Ford is said to have offered the Chicago, Milwaukee & St. Paul Railway power to serve in electrifying its main line from Minneapolis to Chicago.

Middle West Utilities Buys a Texas Property

Construction of extensions and a general expansion of electric power transmission lines and plants in a large area of central western Texas will be started soon as a result of the purchase by the West Texas Utilities Company of Abilene of all the holdings of the Interstate Electric Corporation of San Angelo, previously an A. E. Fitkin property. The consideration involved in the transaction was approximately $1,500,000, it is announced. The acquired properties include the electric light and power and waterworks plants at San Angelo, the electric light and ice plants at Ballinger, the electric light plants at Winters, Rowena and Miles and the power transmission system which connects these towns. The West Texas Utilities Company is already serving thirty-four towns in that part of the state over its power lines, and these will be connected with those just acquired. The central power stations at San Angelo and Abilene will be enlarged.

The West Texas Utilities Company, which has an investment of about $8,000,000 in Texas, is a subsidiary of the American Public Service Company of Texas and Oklahoma, which in turn is controlled by the Middle West Utilities Company of Chicago.

Standard Gas Makes Directors of Operating Executives

The Standard Gas & Electric Company has adopted a new policy of broadening executive responsibilities in the operation of subsidiary companies. At a recent meeting of directors six operating executives were elected members of the board. These operating executives are vice-presidents and general managers of some of the large utility companies directed by the Byllesby Engineering & Management Corporation.

In working out the new arrangements it was necessary to increase the directorate from seventeen to twenty-three members. The operating executives elected to the board are T. K. Jackson, president and manager Mobile Electric Company; W. F. Raber, vice-president and general manager San Diego Consolidated Gas & Electric Company; R. F. Pack, vice-president and general manager, and H. H. Jones, vice-president in charge of operation, Northern States Company; J. F. Owens, vice-president and general manager Oklahoma Gas & Electric Company, and Samuel Kahn, vice-president and general manager Western States Gas & Electric Company of California.

Fire Destroys Santo Domingo's Electric Plant

Fire recently destroyed the generating plant of the Compañia Eléctrica de Santo Domingo, Santo Domingo City, Dominican Republic, with a loss of virtually the entire installed equipment. The installation consisted of two water-tube boilers and two 500-kw. horizontal turbo-generators of General Electric manufacture. As this was the only power plant on the system, the city of Santo Domingo will be without electric service until it is rebuilt.

The fire is reported to have been caused by sparks from a hand forge igniting oil-soaked planking adjacent to the fuel-oil heater. Planking was also used over the condenser pits in the turbine room, and as the partition between the boiler and turbine rooms was also of wood, the fire spread rapidly. Fortunately the fuel-oil tanks did not explode. An unusual feature of the catastrophe was the explosion of a condenser because of entrapped water. Both of the 500-kw. turbines were so badly damaged and warped that it is impossible to salvage them.

The General Electric Company made the unusual delivery promise of four weeks on a new 300-kw. turbo-generator unit to be followed a week later by one of 500 kw. capacity. A third unit, also of 500 kw. capacity, will be added later.

California Merger Likely

San Joaquin Company Will Probably Be Taken Over by Owners of Great Western

WORD comes from California that a merger of the Great Western Power Company and the San Joaquin Light & Power Corporation is under discussion and that preliminary steps toward the purchase of the latter property have been taken by the Western Power Corporation of New York, holding company of the Great Western Power Company and the California Electric Generating Company, both operated from San Francisco. For several months the Western Power Corporation has held an option on the San Joaquin property the exercise of which was delayed pending the return of W. G. Kerckhoff, president of the San Joaquin Light & Power Corporation, from Europe.

In New York H. P. Wilson, president of the Western Power Company, said to press representatives that negotiations have not proceeded far enough to warrant an announcement. "We may buy San Joaquin Light & Power if the terms are satisfactory, and we may not," Mr. Wilson is quoted as saying. "We have had discussions on this subject for about three years." A. C. Balch, vice-president of the San Joaquin company, which, with headquarters at Fresno, serves also Bakersfield and a score of other central California communities, has been in New York for several weeks.

Plans for construction work to follow the merger are said to provide for erecting a 100,000-kw., 220-kv. line from the Brighton substation of the Great Western Power Company at Sacramento to Merced, thence to Fresno, and its ultimate extension further south, possibly as far as Bakersfield. By this construction the total potential power of the Feather River district, amounting to 100,000 kw., would become available for distribution throughout the entire consolidated territory. The storage capacity of the Big Meadows Dam on Lake Almanor will be increased immediately by raising the water level 45 ft., thus providing a total water storage of 1,317,000 acre-feet. This storage is equal to the total combined water storage of all the utilities in California. The present dam of the Great Western Power Company on this site was finished last summer. It is 1,200 ft. long and of the hydraulic-fill type. The reservoir covers 1,500 acres where once existed a well-known Butte Valley mining camp.

Mr. Fleishhacker Resigns

The resignation of Mortimer Fleishhacker as president of the Great Western Power Company is reported on account of ill health, but the Fleischhacker interests are still dominant in Great Western affairs.

Commercial Section's Profitable Gathering

N. E. L. A. Committees at San Rafael Plan for Employees' Service Manual and Hear Encouraging Reports on Ranges, Electric Refrigeration and Other Timely Matters

A GOOD attendance and lively discussion marked the three-day conclave of the Commercial National Section committees of the National Electric Light Association held at San Rafael, Cal., November 19 to 21. The meeting proved particularly profitable in developing better understanding between central-station commercial men of the East and the West.

As reported in last week's issue of the ELECTRICAL WORLD, the first day was given over to meetings of the lighting, power and appliance committees. The meeting of the customers' relations committee on Thursday showed that all member companies are co-operating fully with the committee in its work. It is realized that the most important point of contact between the central-station company and the public is the employee, and efforts are therefore being made to improve his status. One of the most important suggestions brought out at this meeting was the idea of preparing an employees' service manual to acquaint them better with the workings of a utility in order that they may better represent the company in its dealings with consumers. Such a manual is now being prepared by the customers' relations committee of the Pacific Coast Electrical Association.

DOMESTIC REFRIGERATION LOAD

Discussion at the meeting of the electric domestic refrigeration committee showed that domestic refrigeration offers big sales possibilities, but that some central-station companies feel that policy matters are involved. There are some mechanical troubles yet to be overcome, but enough machines have been sold to indicate great satisfaction on the part of their purchasers. Central stations now selling refrigerators generally absorb service costs, and some companies are trying to work out a flat rate for this service. Maintenance costs are so low in many cases as to seem incredible. P. M. Parry, Salt Lake City, said that on a 9-cent lighting rate electric refrigeration is about comparable in cost with ice in his territory. The opinion was expressed that next year should see sales progress in domestic electric refrigeration equivalent to that of the past ten years.

Chairman A. McMicken of the electric cooking and heating committee said that an effort is being made to convert the committee into a fact-finding and co-ordinating body and that the real work is being done by the geographic sections. In a report read by Lewis A. Lewis, chairman of the cooking and heating committee of the Northwest Geographic Division, it was shown that the problem of securing full and complete data on electric ranges is a national one which must be borne by the industry as a whole. The survey now under way will cover all engineering as well as commercial phases of the problem. It is hoped to obtain data on demand diversity and load characteristics of groups of ten, twenty-five and fifty to one hundred and fifty ranges. Transformer capacity, investment costs, wiring costs, maintenance and life of ranges will also be covered. Although some work has been done, the field tests will not get under way until early next year owing to a delay in receiving equipment. Three seasons—winter, spring and summer—will be covered in the tests, and it is hoped to be able to present a report on the winter investigation at the N. E. L. A. convention next June. Tests already made indicate that very satisfactory results will be obtained. The instruments used in the survey will not be salvaged, but will be available for use in any section of the country where tests are desired.

WATER-HEATER SERVICE

R. C. Bragg reported satisfactory progress on the survey of metered water heating being made by the Pacific Coast Geographic Division. The report of this committee is expected to show about ten thousand water heaters in service, about 95 per cent of which are on meters, with an average rate of approximately 2 cents.

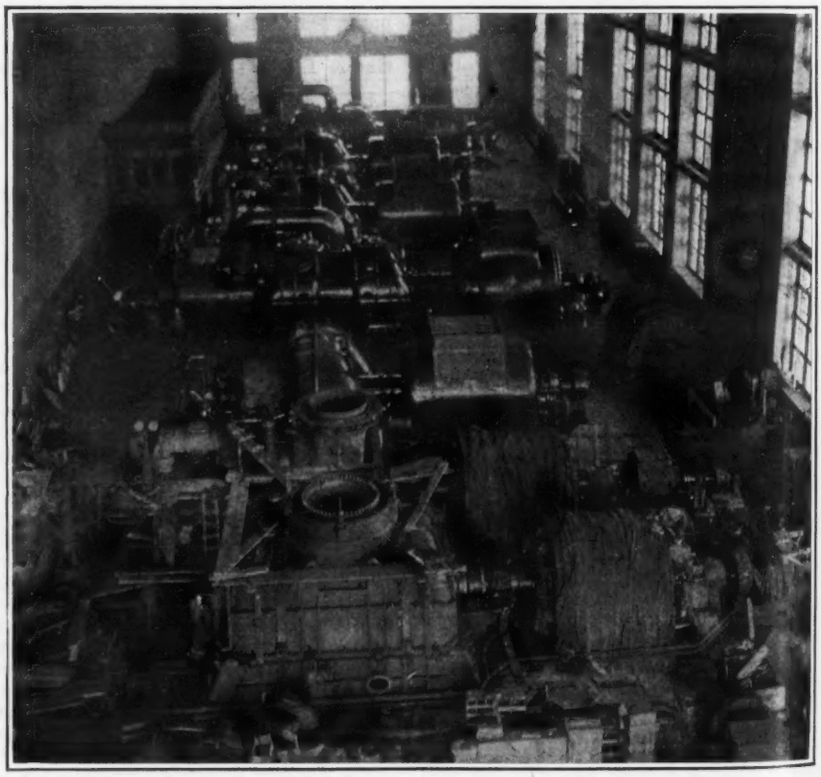
The range maintenance committee reported that about twenty central stations throughout the country have put in a uniform system of compiling service costs on electric ranges, and it is hoped to compile very valuable information. Satisfactory progress was reported by the wiring committee on its efforts to draw up a standard set of specifications to reduce the cost of wiring electric range services.

ELECTRIC TRANSPORTATION

In the meeting of the transportation committee it was reported that a number of trade associations have compiled information showing the advantages of electric trucks in their business. This should help to lower the sales resistance encountered by central stations and electric truck manufacturers. The most successful selling methods have been found to be actual demonstration and accurate operating cost data. Some power companies, it was stated, are not yet fully convinced of the advantage of the electric truck from the standpoint of service and revenue. The point was made that central-station companies must co-operate with electric railway systems in the solution of some of their problems, such as bus competition, if energy sales to electric railway systems are not to decline.

A general conference held on Friday morning was devoted largely to the

New Turbine-Generator for Hell Gate Station



THE above picture of the turbine room of the Hell Gate station of the United Electric Light & Power Company, New York City, taken a few weeks ago, shows progress on Unit No. 6, the 56,000-kw. cross-compound generator which will go into operation on schedule time in December. It will increase the maximum capacity of the station from 185,000 kw. to 241,000 kw.

subject of electrical energy on the farm.

F. A. Leach, Jr., president of the Pacific Coast Electrical Association, said that better lighting in the home paves the way to greater use of household labor-saving devices. E. A. White, chairman of the Committee on the Relation of Electricity to Agriculture, said that the electrical industry and agricultural interests have a mutual responsibility which must be recognized before maximum results will be accomplished. Out of the movement started by the N. E. L. A. it is hoped to determine the maximum possible economic uses for electricity on the farm. What the farmer must have, according to Mr. White, is confidence in the electrical man and what he has to say. In the last analysis the source of energy best adapted as a prime mover will come out on top and is the one that should be used for any given operation.

L. J. Fletcher, chairman of the California committee, said that the electrical industry has a state and national obligation, and that the obligation of the state is to find out what is the best practice and to find new economical uses for electricity on the farm. Four major projects are under way by his committee, viz., utilization of electrical energy on dairy farms, in the poultry industry, in the dehydration of fruit and in the improvement of pumping.

The next meeting of the Commercial Section will be held in New York City on March 17 to 19.

Lighting Contests: 4,586

Great Lakes Division Leads in Communities Organized—Many Million Persons Reached

WITH the Great Lakes Division leading with 987 communities, the regional directors of the better home-lighting campaign report a total of 4,586 communities as having held contests in the past two months. These communities represent a total population of 47,000,000, or 76 per cent of the population in the United States that is served by electricity. The Eastern division, which was divided into directorships of Arthur Williams, W. E. Robertson, R. R. Young, W. H. Wade and M. E. Skinner, has the greatest population of any one division—16,627,454. The Great Lakes Division, which was directed by J. F. Gilchrist, assisted by four state directors, has the second greatest population, or 9,128,901. The regional directors having smaller territories than these have likewise done excellent work in organizing their divisions and will have an equal chance for the regional directors' prize, which will be awarded on a percentage basis.

COMMUNITIES ORGANIZED FOR HOME-LIGHTING CONTEST

Division	Population	Communities Organized
Great Lakes	9,128,901	987
Eastern	16,627,454	875
Middle West	3,300,487	615
New England	4,076,277	515
Southwestern	2,703,323	294
Pacific Coast	2,420,703	285
East Central	4,076,751	278
North Central	757,423	252
Southeastern	2,025,648	225
Rocky Mountain	499,799	140
Northwestern	837,195	74
Middle Atlantic	1,094,942	46
Total	47,548,903	4,586

The following are new subscribers to the fund of the Lighting Educational Committee, making a total of 154 contributors:

Alexalite Company, New York.
Chicago Insulated Wire & Manufacturing Company, Sycamore, Ill.
Davis-Jones Insulated Wire Company, Pawtucket, R. I.
Detroit Insulated Wire Company, Detroit.
Goodyear Rubber Insulating Company, New York.
Great Lakes Electric Manufacturing Company, Chicago.
Handel Company, Meriden, Conn.
L. & N. Company, St. Johns, Quebec, Canada.
Lincoln Manufacturing Company, Detroit.
National Pole Company, Escanaba, Mich.
Siemon Company, Bridgeport, Conn.
Wadsworth Electric Manufacturing Company, Covington, Ky.

Central Station and Jobber

Tripp Tells Supply Men that Manufacturers Can Ill Afford to Market Directly

THE old, familiar chain of jobber-dealer-contractor distribution still remains the most economical, according to General Guy E. Tripp, chairman of the board of directors of the Westinghouse Electric & Manufacturing Company, who expressed this view before the annual winter convention of the Electrical Supply Jobbers' Association in Cleveland last week. The rising cost of selling, he said, is gradually making it more and more impossible for a manufacturer selling to industry to do his own marketing direct. The trend in development is steadily growing away from the old conception of the central station as a purely local affair and toward the organization of great corporations that are becoming national rather than local enterprises. But these organizations naturally desire to deal directly with the manufacturer, and they demand discounts as good as the jobber gets. The central station cannot be all things, General Tripp declared, and the jobber can be expected to continue to be a better merchant. The jobber who will multiply and extend the advantages of the service which he offers to his customers will be setting up the best possible defense and the strongest assurance of continuing prosperity.

Thursday was set aside in the jobbers' program for two open general meetings. A. Penn Denton, president of the Denton Engineering & Construction Company, Kansas City, Mo., and chairman of the Association of Electragists' National Electrical Code committee, outlined the progress that is being made in the organization of local code committees and presented an intensive study of the present code situation, showing on charts the former organization of the code and the present program organized under the American Engineering Standards Committee.

The public is demanding steadily increasing safety in electrical systems, Mr. Denton said, and eighteen cities are now requiring an all-metal code within the corporate limits. The all-metal system is proving most economical in the long run, and it offers distinct advantages in the permanently grounded neutral and the multiple ground to system and to equipment.

Powell Crosley, Jr., president of the Crosley Radio Company, spoke on radio from the commercial standpoint, discussing the future possibilities for the jobber in developing the radio market and advocating that the radio department in the electrical jobbing house be placed upon its own feet by means of the plan that is being followed by phonograph distributors. The greatest selling influence in the selling of radio material by the jobber to the contractor is service, and the jobber that provides the proper service, thus stimulating friendly relations with the contractor, can feel assured of holding that contractor's business. The radio business of the jobber, Mr. Crosley said, must be put on its own feet, if the jobber is to expect to hold his position in the industry when the sale of radio equipment settles down.

The story of local league organization was told by Earl E. Whitehorne, commercial editor of the ELECTRICAL WORLD and vice-chairman of the League Council, who called upon the jobbers to support the league movement individually and as an organization by patient encouragement of the leagues in their own home towns.

The Electrical Supply Jobbers' Association has decided to discontinue the publication of its monthly organ *The Reminder*, and voted an appropriation for the support of the educational course for contractors which is being developed by a committee under the chairmanship of O. Fred Rost, Newark, N. J. This committee will co-operate actively with the Association of Electragists and the Society for Electrical Development.

Peninsular Power Company Bought by North American

Through the purchase of the electric properties of the Peninsular Power Company, Madison, Wis., which supply light and power service to communities and mining industries in the northeastern part of Wisconsin and the upper peninsula of Michigan, the North American Company, New York, has added to its already extensive utility holdings in those states. The price is reported as $3,500,000. The properties consist of four hydro-electric power plants, two on the Menominee River near Florence, Wis., and the others near Twin Falls, Mich., and Loretto, Mich. The combined annual output of these plants is 60,000,000 kw.-hr. This power is distributed in the Gogebic iron range district to thirty-two mines, eleven other utility companies, four lumber mills and one pulp mill over transmission lines covering 120 miles. Power has been wholesaled to the municipal electric plant at Florence, Wis., and the Iron Mountain Light & Power Company at Iron Mountain, Mich., for redistribution to domestic and commercial consumers.

During 1923 the company did a gross business of $598,000. A majority of the stock of the company was held by prominent business and professional men in Madison. Outstanding capitalization consists of $1,552,500 in 7 per cent preferred and $1,200,000 in common stock.

Present Status of Muscle Shoals

What the Government Has Accomplished in Six Years—Plant Cannot Be Ready for at Least Seven Months—Figures on Actual Horsepower

ADVANTAGE of the Congressional recess and the temporary cessation of the din over hydro-electric development at Muscle Shoals has been taken by one of the applicants for permission to develop power there, Elon H. Hooker, to bring about the preparation of a succinct statement of the present condition of the Muscle Shoals enterprise and an estimate of its possibilities—facts concerning which he holds the public to be in need of enlightenment. Mr. Hooker, the president of the Hooker Electrochemical Company of Niagara Falls, N. Y., joined, it will be remembered, with W. W. Atterbury, vice-president of the Pennsylvania Railroad, and James G. White, who controls the J. G. White Engineering and Management corporations, in making a bid for Muscle Shoals in which special emphasis was laid on fertilizer production. The facts now put forth for the information of all interested in Muscle Shoals were summarized by Mr. Hooker's engineers in co-operation with the government's engineers and have been embodied in a statement by Nat Olds of New York City, part of which follows in substance.

The popular conception of the condition in which Muscle Shoals stands today seems to be that it is ready at a moment's notice to produce power and to manufacture fertilizer as soon as the government decides what to do with it. This idea is erroneous. Muscle Shoals is not completed and will not be ready to deliver power for any purpose for at least seven months.

Survey of Construction

Brigadier General Harry Taylor, in charge of construction at Muscle Shoals, reported to the Senate on May 24 last that, at the present rate of progress, Dam No. 2 should be completed by July, 1925. This is known as the Wilson Dam, and upon it depends the operation of all the manufacturing plants built or to be built. It is the keystone of power production at Muscle Shoals. This great dam was begun in July, 1918, and work was stopped on it from the spring of 1921 to the fall of 1922 because Congress did not at the former time appropriate funds to continue its construction. It is four-fifths of a mile long and 97 ft. high. It has already cost $30,000,000, and $21,000,000 more will be required to complete it.

Dam No. 1, of which the estimated cost is $1,600,000, has not yet been begun because Congress has not authorized the appropriations, and the same is true of Dam No. 3, which would take three or four years to build at an estimated cost of $27,300,000.

Nitrate Plant No. 1 has been completed, but is a failure and must be remodeled. It is built near Sheffield, Ala., on the south bank of the Tennessee, 5 miles from Wilson Dam. It covers an area of 1,900 acres, includes a steam plant rated at 5,000 kw. and cost $13,000,000.

Nitrate Plant No. 2, on the south bank of the Tennessee, 1 mile down stream from Wilson Dam, is a success and has a capacity of 40,000 tons of nitrogen a year. It contains a 60,000-kw. steam plant with 50 per cent expansion radius, covers 2,300 acres and cost $66,000,000—$54,000,000 for the nitrate plant and $12,000,00 for the steam plant. The Waco limestone quarry at Russellville, 25 miles south of Muscle Shoals, was acquired for the nitrate plant and cost $1,300,000.

Misunderstanding About Power

Wild statements have been made about the volume of power which the damming of the Tennessee River at Muscle Shoals will produce, figures running as high as 900,000 hp. and 1,000,000 hp. having been put forth. As a matter of fact, when Dam No. 2 and Dam No. 3 are completed they will, the engineers estimate, deliver about 121,000 primary horsepower. The period during which 1,000,000 hp. could be derived is a little less than one month in the year.

The following table gives an analysis of the horsepower volume, estimated by months, at Dams No. 2 and No. 3:

Class	Dam No. 2	Dam No. 3	Total
Primary	87,300	34,000	121,300
More than ten months	137,000	55,000	192,000
More than six months	237,000	95,000	332,000
More than four months	292,000	117,000	409,000

The government has had Muscle Shoals on its hands for six years and has done nothing with it, except continue the Wilson Dam when Congress would vote the funds. The plant has been there, built by the people's money, and by the terms of the enabling act is dedicated to the manufacture of explosives in time of war and of cheap fertilizer in time of peace. To push a plant like that through to completion and then to operate it profitably, the statement concludes, requires what government methods do not generate. This is initiative and drive. Consequently the great plant is still unbuilt. What will the government do with it?

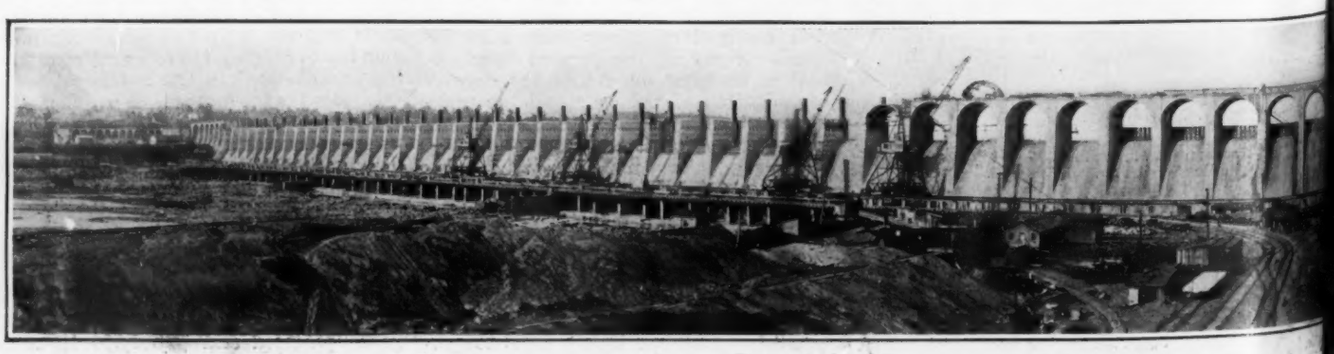
Is Dam No. 3 Needed?

Should Be Built by 1931, Says Major Tyler, if Southern Network Is Used for Power

DAM No. 3 on the Tennessee River will be needed by 1931, in the opinion of Major Max C. Tyler, expressed in a special report to the Chief of Engineers of the United States Army, if the power from Dam No. 2 is distributed through the interconnected system of the Southeastern power companies and into new territory southwest of Muscle Shoals. Since four years will be required to build dam No. 3, almost immediate action must be taken toward obtaining the necessary legislative authority and the appropriation. If it should be found feasible to operate the nitrate plant, Dam No. 3 would be needed in 1929.

"If power from Dam No. 2 and the steam station is distributed locally and into new territory," says Major Tyler, "and is not sold or otherwise made available to the power companies for distribution through their transmission net, it will take a long period to load up the two plants, and there would be no justification at this time for the construction of Dam No. 3. If power is supplied only for the operation of Nitrate Plant No. 2 and for local distribution and distribution in new territory, the time when the capacity of Dam No. 2 and the steam plant will be reached also is problematical. Nitrate Plant No. 2 requires about 100,000 hp. at full load. If we assume that Nitrate Plant No. 2 will use 75,000 hp. in three years, or say 450,000,000 kw.-hr. per annum, there will remain available capacity of about 400,000,000 kw.-hr. per annum for local and new territory distribution.

"Dam No. 3 is worthy of construction by the United States at the present time, provided that before authority for constructing it is given by Congress and appropriation of funds is made Dam



WILSON DAM, THE FIFTY-ONE-MILLION-DOLLAR UNITED STATES GOVERNMENT

No. 2 and the steam plant are leased under the provisions of the federal water-power act, so as to insure the distribution of power through the interconnected system and in new territory to the west and southwest and under terms which will earn for the United States interest and depreciation at reasonable rates on the capital invested therein for power purposes, viz., $42,199,162, and further, that the lease also cover Dam No. 3, at completion, with provisions for reasonable interest and depreciation payments to the United States on the capital to be invested therein for power purposes, estimated at $28,200,000; or, if the plants are operated by the United States and power is sold, that long-term contracts, covering approximately the combined capacity of Dam No. 2, the steam plant and Dam No. 3 be made with public service corporations for purchase of power for distribution through the interconnected system and in new territory to the west and southwest at such prices for generator voltage power at the plants as will pay maintenance and operating expenses and a reasonable rate of interest and depreciation on the capital invested or to be invested in the three plants for power purposes.

"The quantity of power that can be produced by the government plants at Muscle Shoals so greatly exceeds the amounts that may be required for fixation of nitrogen that the nitrate plants should be considered only as prospective large customers of the power plants. The solution of the nitrate-plant problem should be made on its own merits, on the assumption that power will be available. It should not obscure the fact that the greatest use, largest returns and cheapest power can be obtained only by a wide distribution of power through the interconnected transmission system."

No Agreement on Muscle Shoals Likely

Conflicting Policies Will Probably Prevent Action at Short Session of Congress—Government's Power to Market Any Energy Produced Is Confirmed

ON THE eve of the convening of Congress for its short session there is very general agreement that no Muscle Shoals policy will be agreed upon prior to March 4. Congress will have about all it can do to get through the necessary appropriation bills, since a portion of the time must be given to the formulation of legislation of basic importance to agriculture.

A definite priority has been given to the disposition of the Muscle Shoals matter, but the only chance for final action would lie in the ability of all concerned to agree on a plan. Such unanimous consent is manifestly impossible, when consideration is given to the sharp differences of opinion held by various groups, each wielding a very considerable political influence. The Tennessee Valley Improvement Association will bring forward its own plan, even if it should be convinced that Mr. Ford would not accept the project were it tendered him under the offer he has withdrawn. It may be mentioned in passing that no one in Washington expects Mr. Ford to figure further in these negotiations, despite the fact that he left the door open in withdrawing his offer.

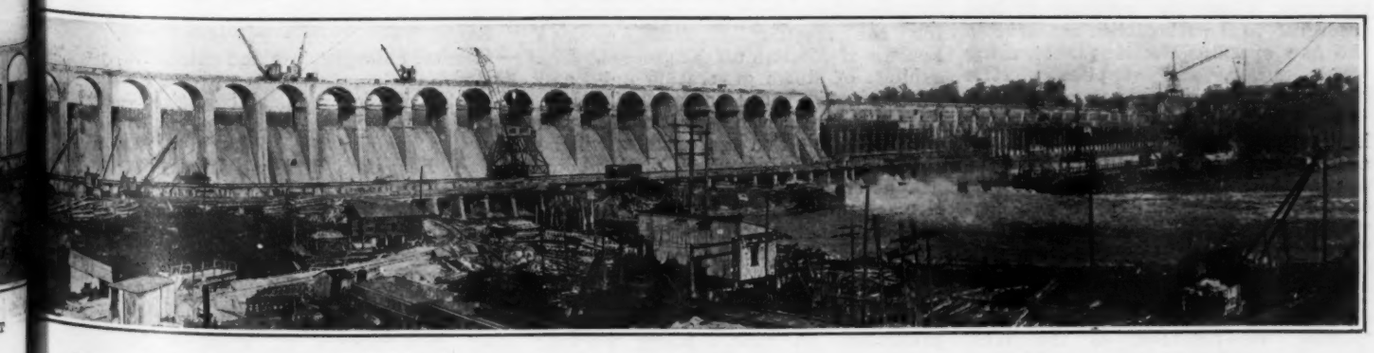
Another group is composed of Senator Norris and those who would install the government in business on a large scale at Muscle Shoals. That group will not abandon passively a principle in which it firmly believes. Then there is the American Farm Bureau Federation with still different ideas as to how the matter should be settled. Another group, formed around Representative McKenzie, is bent on putting through a great experiment in fertilizer manufacture. Others have little desire to see Uncle Sam undertake the manufacture and distribution of fertilizers. They want to see the power made available for public utility use.

About as far as Congress is expected to get is to provide for further study of the Muscle Shoals problem. This apparently would leave the project largely in the hands of the Secretary of War, who has announced that he will have no hesitancy, as legal custodian of the property, in applying a businesslike policy to its temporary disposition. A decision announced last Thursday from the Judge Advocate General of the army sustained the government's right to sell such power as can be carried away from Muscle Shoals when the Wilson Dam is completed. This involves, however, the construction of a high-tension substation and the installation of more transmission-line capacity. Since there will be no market for power at Muscle Shoals in July, when the plant will be ready for operation, it is apparent that the power must be fed into existing distribution systems. Rather than lose an income of many thousands of dollars a day, which readily can be obtained for the power, it is assumed that the Secretary of War will feel free to put in the necessary transforming station.

ALABAMA POWER'S POSITION

The Alabama Power Company, which owns the only existing transmission line and the right-of-way which it occupies, might hesitate before incurring the expense of increasing its transmission-line capacity. In making temporary disposition of the power the War Department could make only very limited commitments. The lease for the steam plant at Sheffield is on a thirty-day basis. When hydro-electric power becomes available the steam plant lease naturally will be terminated. It is recognized as a possibility that the Alabama Power Company would be willing to supplement its 30,000-kw. transmission line with additional facilities, but even were the Alabama Public Service Commission to relent and grant a certificate of convenience and necessity for the purpose, the company probably would not feel justified in putting up more than makeshift construction until it could have some assurance of permanency in its arrangement for power. Were makeshift arrangements made to transmit as much as 100,000 kw., it would involve great waste, a burden which must be borne ultimately by the consumers of the electricity. It is thought the Alabama Power Company would be in a position to rig up some sort of additional transmission-line capacity without having to undertake special financing for the project.

A plan is said to be afoot looking to the securing of the power to be developed at Muscle Shoals for use in Memphis, Cairo, St. Louis and intermediate points as well as for other places which would be in the region adjacent to the route of the transmission line. In this connection the suggestion has been made that it would be more to the public interest were the power from Muscle Shoals transmitted southward rather than northward. Louisiana and Mississippi are in great need of additional supplies of power. They have no hydro-electric resources.



STRUCTURE AT MUSCLE SHOALS, ALA., AS IT APPEARED A FEW WEEKS AGO

National Agreement on Rating River Water Power Sought

The United States Geological Survey has proposed to the American Engineering Standards Committee that a national agreement be worked out on methods of rating the water power of rivers—a subject concerning which there has been recent discussion in the ELECTRICAL WORLD. In its request the Geological Survey says:

"The engineers of the Geological Survey have struggled with the problem of rating rivers . . . and have within a few years adopted the rule of rating on the basis of 50 per cent and 90 per cent flow. This rule has been adopted by other organizations, but is by no means universally used. There is therefore much confusion in statements relating to the capacities of rivers for developing power and a real need for the adoption of a standard. The necessity for a standard was obvious at the World Power Conference in London, as statements of power resources for different countries were made on different bases and therefore were not comparable. Any action taken in this country should recognize the practice in other countries and should conform, if practicable, to a world standard."

In response to this request, the A. E. S. C. will communicate with other organizations which may be interested, and if the general sentiment is in favor of the undertaking a sectional committee will be organized for the work. Expressions of opinion on the subject are invited by the American Engineering Standards Committee, 29 West Thirty-ninth Street, New York City.

National Grange Sees Visions of "Power at Cost"

Meeting at Atlantic City, N. J., recently, the National Grange, representing nearly a million farmers in this country, unanimously adopted a resolution supporting the proposed Federal Public Service Commission for the development of superpower plants, with the special purpose to supply electric power and light at cost to rural communities. In the resolution also the Grange declares that "the force of discussion and influence of all our granges will be directed to attaining light and power at cost for all people."

The proposed power plan would, it was explained, be in line with that now in effect in Ontario and other Canadian provinces where the government has, according to the resolution, constructed and now operates electric plants, using water power, and supplies electric light and power to citizens at cost.

The resolution states that Grange leaders, papers and lecturers will take a vigorous part in the anticipated campaign. A comprehensive plan for this campaign was submitted to the convention by a committee of the National Grange during the meeting in Pittsburgh last year.

A reply to the resolution of the National Grange was issued by G. M. Gadsby, vice-president of the West Penn Power Company and president of the Pennsylvania Electric Association, who spoke from Atlantic City while attending a meeting of the New Jersey Utilities Association there. "Experience," said Mr. Gadsby, "has shown and is showing that the cost of operation of government enterprises is in excess of the cost of like operations under private management. With government power plants, therefore, there would probably be a rise in rates instead of a decrease, unless they were to be deliberately conducted at a loss, in which case all taxpayers would bear an additional tax burden so that power consumers might have cheap service."

Metropolitan Electrical League Formed at Boston

Two hundred representatives of the various branches of the electrical industry met at the Boston Chamber of Commerce on November 13 and formed the Metropolitan Electrical League of Boston to develop a broader acquaintanceship and greater spirit of camaraderie in the local electrical field and also to afford a medium through which the industry's combined interests may be expressed in matters affecting the commercial and industrial well-being of the community. The organization is the outcome of more than two months' study on the part of a central committee headed by Frank S. Price, president Pettingell-Andrews Company, Boston.

At the meeting E. W. Longley, vice-president New England Telephone & Telegraph Company, Boston, presided, and a unanimous vote in favor of organizing the league followed an address on the ethics of modern business by Rev. Dr. Henry H. Crane of Malden, Mass. Everett Morss, president Simplex Wire & Cable Company, Boston, was elected president of the league, H. T. Sands of Charles H. Tenney & Company, Boston, being vice-president. J. J. Caddigan of the Edison Electric Illuminating Company of Boston is secretary and treasurer. A series of eight electrical luncheons will be held prior to June 1, 1925. The organization has the backing of the most representative men of the industry in the Boston district.

Third Annual Power Show to Be Held Next Week

The third National Exposition of Power and Mechanical Engineering will open on Monday, December 1, in Grand Central Palace, New York City, and will continue throughout the week, paralleling the meeting of the American Society of Mechanical Engineers. The exhibits of steam generating units and prime movers will be of great interest. Several manufacturers of boilers will exhibit models and the exhibits will be amplified with drawings and photographs showing modern boiler installation. Radiant-heat superheaters, economizers, etc., will also be shown. Apparatus designed to increase the effectiveness and economy of combustion will form an important part of the exhibit. There will be two types of air preheaters on view. Many working models of stokers will be in evidence as well as exhibits of the recent designs of burners for pulverized fuel. Refractories, high-temperature insulation, condensers, cooling towers and steam-jet, hot-well and vacuum pumps will also be well covered in the show.

The educational value of the Power Show will be broadened by a series of lecture courses. These will treat the critical problems of power development, and those who attend will then have the opportunity to go out on the floor and observe how the problems are solved by the different manufacturers represented. The courses will be open to students at engineering schools, the faculties of which are co-operating with the management of the exposition. The managers are also arranging a series of educational and historical exhibits. The showing of different types of fuels which was so successful last year will be elaborated and extended this year. Large-scale models of modern power plants will be displayed.

Among the lectures will be one on hydraulic equipment by William W. White, manager hydraulic department Allis-Chalmers Manufacturing Company; one on handling of materials by Matthew W. Potts of *Industrial Management*, New York; one on steam prime movers by C. Harold Berry, Detroit Edison Company, and one on oil and gas engines by Prof. Charles E. Lucke of Columbia University.

Big Program of Los Angeles Power Bureau

Claiming that the Municipal Power Bureau of Los Angeles distributes more than 90 per cent of the power supplied to manufacturing plants in that city, E. F. Scattergood, chief electrical engineer of the bureau, recently outlined a construction program to be undertaken by the city which will involve an expenditure of more than $7,000,000 in the next three years. Mr. Scattergood said that industrial power consumers served by the Power Bureau at the present time have a total motor connected load of 190,000 hp. The added demand for power during the next year is conservatively estimated at 40,000 hp., an increase of more than 25 per cent. The Power Bureau's three-year program of extensions and enlargements will provide facilities for the distribution of 330,000 hp., or 140,000 hp. more than now. This amount is apportioned in the bureau's budget as follows:

East Los Angeles—For substation facilities, enlarging and extending power lines, $960,000.

Santa Fé-southeast industrial area—General enlargements and extensions, $1,400,000.

South Park industrial district—Power-line enlargements and extensions, $1,100,000.

San Fernando Valley—Greatly increased facilities for heavy power service, $1,200,000.

Florence Avenue and Shoestring district—Extensions and improvements to heavy power service, $700,000.

Harbor district—Extending and enlarging power service facilities to meet requirements of great waterfront industries, $1,350,000.

Uniform Regulatory Laws

Importance of Agreement in State Practice Strongly Urged by Commissioners

THE importance of bringing about uniformity in the practice of the fifty-two public utility commissions set up in the states and territories of the country was emphasized at the recent meeting in Phoenix, Ariz., of the National Association of Railway and Utilities Commissioners. A committee under the chairmanship of Lewis E. Gettle, head of the Wisconsin Railroad Commission, prepared drafts of model uniform laws covering franchises, regulation of stock and bond issues, mergers and intercorporate relations of companies. These drafts were embodied in an exhaustive report of twenty thousand words.

One of the recommendations of the committee is that municipally owned plants should come under state regulation. The committee says on this point: "Municipal ownership in and of itself is no assurance against an unreasonable rate of return and the exaction of excessive rates from utility customers. Such, at least, has been the experience of the Wisconsin commission."

An analysis by the commission of the 1923 income accounts of Wisconsin electric utilities disclosed eleven cases in which existing rates were yielding an excess return, the total return approximating, in several instances, from 10 to 20 per cent of the fair value of their property.

OVERCHARGES BY MUNICIPALITIES

"Nine of the eleven cases," the committee goes on, "involved municipal plants, and the commission suggested to these municipal utilities the advisability of informal rate reductions. Several of the municipalities not only objected to a rate reduction, but assumed an almost belligerent attitude, and the institution of formal rate reduction proceedings on the commission's own motion became necessary. No doubt in these, as in other cases, city officials were averse to rate reductions for the reason that excess utility earnings are reflected in lower tax rates, which are popularly interpreted as evidence of administrative efficiency.

"Had the utilities been privately owned, on the other hand, it is more than likely that these same city officials would have been active in instigating rate reductions."

The question of superpower in itself makes uniform laws imperative, in the view of the committee, which says on this point:

"To secure for the people of this country the equitable rate and service benefits which will be derived from the development of superpower systems and from the economically justifiable consolidations of companies, it is necessary that uniform laws applicable to all states be adopted. Of course, the legislatures of the states will have the final say, and the stimulation created by the divergence of opinion is likely to be profitable to the public.

"Our vital purpose is to secure such uniformity in the laws as will at least represent the same principles of regulation covering properties of public utility companies whose service extends over territory in two or more adjacent states, to the end that the state commissions may be able to investigate and handle jointly and in comity the problems concerning public utilities."

Briefer News

Abitibi River Plant of Mining Company Nearly Ready.—The Hollinger Consolidated Gold Mines Company, Timmins, Ontario, is on the eve of turning on hydro-electric energy from its newly constructed power plant at Island Falls on the Abitibi River. The first unit is rated at 12,000 hp., and a second and final unit will be completed within a short time.

Million-Pound Thrust Bearing.—The enormous thrust bearing shown in this photograph is one of five made by the General Electric Company for five 54,000-kva. vertical-shaft generators built by the Canadian General Electric Company for installation in the Queenston station of the Ontario Hydro-Electric Commission. The bearing is 69 in. outside diameter, and is of the

spring-thrust type, being guaranteed to carry a load of a million pounds at a normal rotating speed of 187.5 r.p.m. The load is made up of the revolving element of the turbine and generator plus the downward thrust of the water. The bearing must also be able to operate at 10 r.p.m. for an hour or at a runaway speed of 350 r.p.m. for an hour. This thrust bearing is installed at the top of the generator in an oil bath, cooled by water coils, and supports the weight of the revolving parts of the generator and turbine and the hydraulic thrust. The polished rubbing surface of the rotating ring of the thrust bearing is shown at the right. The babbitt-faced stationary ring is assembled in its place, resting on 672 helical springs. The base ring under the springs is used to allow a sufficient depth of oil to accommodate the water-cooling coils surrounding the bearing.

Seattle Agrees on Price of Substations to Be Taken Over.—The city of Seattle will take over from the Puget Sound Power & Light Company the substations at North Seattle and Fremont, furnishing energy for the operation of the street railway, at a total cost of $141,317, the value reported by a board of appraisers (see ELECTRICAL WORLD, November 1, page 967). A bill has been introduced in the Council providing for payment of the award by a temporary loan from the light fund to the municipal light extension bond 1921 construction fund.

New Dam at Columbia, Tenn., Being Pushed to Completion.—Rapid progress is being made in the construction of the Southern Cities Power Company's new dam across Duck River at Columbia, Tenn. According to G. S. Nunemaker, vice-president and general manager of the company, it is expected that the dam will be completed by February, unless high water interferes with the work in progress. When the dam is completed it will give the local plant 2,000 hp., which will greatly improve service conditions throughout the section.

California Oregon Power Company Completes New Line.—A transmission line 78 miles in length extending from Copco No. 2 plant, now under construction, to Delta, Cal., has just been completed by the California Oregon Power Company. The line has a capacity of 30,000 kw. and will operate at 110,000 volts to deliver the output of the new Copco plant to the Pacific Gas & Electric Company. Until the completion of the plant about May 1, 1925, the line will be used to transmit energy from other plants on the California Oregon Power Company's system to that of the Pacific Gas & Electric Company.

Interstate Power Company Moves Headquarters to Albert Lea, Minn.—The Interstate Power Company, which serves about seventy-five towns in southwestern Wisconsin and northeastern Iowa, is moving its general offices from McGregor, Iowa, to Albert Lea, Minn. The move is the result of the recent acquisition by the Interstate of the properties of the Southern Minnesota Electric Light & Power Company. The Interstate, which is a subsidiary of the Utilities Light & Power Corporation of Indiana, by the purchase within the last few months of several small light and power concerns of Iowa and Wisconsin in addition to buying the Minnesota property, has become a concern capitalized at $8,500,000.

Hydro-Electric Development in the Irish Free State.—It is reported that four Swedish and Swiss experts appointed by the Irish Free State government to examine the scheme submitted by the Siemens Company of Berlin for the harnessing of the River Shannon for electrical power purposes have approved of the project. The government is now considering whether the necessary money shall be provided from public or private sources, but whatever the ultimate decision it will retain a controlling interest. Doctor Borgquist, the Swedish expert, expressed the opinion that the Shannon scheme was the only one that would serve for national industrial development. Smaller sources of water power could be drawn upon in the counties of Galway, Kerry, Kilkenny and Wexford to feed the national distribution network.

Sixty Farms Co-operate in the Garner (Iowa) Rural Service Tests.—Three organizations, the Iowa Farm Bureau Federation, the Iowa Light & Railway Company and the Iowa State College at Ames, are represented in the experiment being conducted at Garner, Iowa, to determine the cost of electricity for various farm operations. Meters have been installed on sixty farms in the territory, and an accurate record is being kept of the cost of operating each unit of farm machinery. Taking of data started October 1, and the experiment will run for five years. The committee, however, expects to have valuable figures at the end of the first six months. Before the experiment is concluded it is hoped to have four or five meters on each farm, each of them connected with a different farm machine.

Varied Program for New England Illuminating Engineers.—Plans for the winter's work of the New England Section of the Illuminating Engineering Society have been announced at Boston. Meetings will be held the fourth Friday of each month at the Engineers' Club until May 22, with the exception of next month's meeting, which will be on December 19. Among the topics under consideration for these meetings are: "Light and Work," "History of the Electric Light," "Display Lighting," "Direct and Indirect Lighting," "Bureau of Standards Methods," "Automobile Headlighting," "Short Cuts in Electric Sign Design," "Development of Luminaires and Glassware," "Photometry" and "Street Lighting." Walter V. Batson is chairman and Irving J. Rosbeck, 60 India Street, Boston, is secretary.

Merger of Tulsa Light Companies Is Approved.—The Corporation Commission of Oklahoma has given its approval to the proposed consolidation of the Tulsa Light & Power Company and the Public Service Company of Oklahoma. The Tulsa Light & Power Company was organized by Martin Insull of Chicago to take over and operate the electric light and power business at Tulsa formerly operated by the Sand Springs Light & Power Company, owned by Charles Page. The Public Service Company of Oklahoma has for years furnished by far the greater part of the light and power used in Tulsa. This company is also an Insull property, a subsidiary of the Middle West Utilities Company of Chicago, and the effect of the consolidation will be to bring the entire light and power business of Tulsa into one organization.

Great Increase in Testing of Current Transformers at Bureau of Standards.—The number of current transformers tested during the past fiscal year at the Bureau of Standards, Washington, was over four times the average number submitted during the preceding six years. The reason for this sudden increase is said to be the adoption of a new method for the testing of this class of apparatus in the field. This method was invented at the bureau and has been incorporated in a convenient testing set which has been on the market for more than a year. The public utility companies throughout the country are anxious to maintain their measuring equipment at the highest accuracy and have adopted this method of testing the current transformers installed on their systems, instead of blindly trusting their accuracy as heretofore. Since the method requires the use of a set of previously standardized current transformers, the bureau has been deluged with requests for this type of standardizing work.

Charges Made Against Pacific Power & Light Company.—The Walla Walla (Wash.) rate commission, which has been for months preparing data for presentation before the Board of Public Works in support of a reduction in power and light rates, charges that the Pacific Power & Light Company has included in the rate base for the district the value of its properties in Umatilla County, Ore. The Walla Walla commission also charges that, in addition to the Oregon properties, there are included in the rate base of the Yakima-Walla Walla district a number of power plants and other properties which have not been used or useful for years for service in the district. These include the plant at Prosser, one on the Tucannon and one at Fruitvale. The commission further charges that the rate of return produces a higher net return than was allowed by the state department.

Seeks Loan for Finnish Power Plant.—The President of the Finland Republic recently signed the ordinance permitting the raising of a foreign loan of £2,000,000 for building the Imatra power plant, which is to supply electricity for a large part of Finland.

Coming Meetings of Electrical and Allied Societies

[A complete directory of electrical associations is published in the first issue of each volume. See July 5 issue, page 50, for latest list.]

American Society of Refrigerating Engineers—New York, Dec. 1-3. W. H. Ross, 35 Warren St., New York.

American Society of Mechanical Engineers—New York, Dec. 1-4. C. W. Rice, 29 West 39th St., New York.

American Society of Agricultural Engineers (Farm Power and Machinery Division)—Great Northern Hotel, Chicago, Dec. 3. Raymond Olney, Mount Clemens, Mich.

Empire State Gas & Electric Association, Electric Division — Syracuse, Dec. 4-5. C. H. B. Chapin, Grand Central Terminal, New York.

West Virginia-Kentucky Association of Mine, Mechanical and Electrical Engineers — Frederick Hotel, Huntington, W. Va., Dec. 12-13. Herbert Smith, Room 211 Robson-Prichard Bldg., Huntington.

Kentucky Association of Public Utilities—Louisville, Jan. 15-16. E. F. Kelley, Louisville Railway Co., Louisville.

Electrical Safety Conference — New York, Jan. 21. R. B. Shepard, 109 Leonard St., New York.

Western Association of Electrical Inspectors — Brown Hotel, Louisville, Ky., Jan. 27-29. G. M. Miller, 1304 South Seventh St., Louisville.

Wisconsin State Association of Electrical Contractors and Dealers—Pfister Hotel, Milwaukee, Jan. 28-30. H. M. Northrup, 23 Erie St., Milwaukee.

E. J. Mehren Speaks at Boston.—E. J. Mehren, vice-president McGraw-Hill Company, addressed the Affiliated Technical Societies of Boston on November 19 upon "Economic Conditions in Europe." The speaker contrasted the present tendency toward stabilization of finance and industry in Great Britain, France and Germany with the economic confusion of 1920 and outlined the relation of the Dawes plan to the reconstruction of international relations and development of trade. He emphasized the improvement of relations between France and Germany which is beginning to be apparent, pointed out the necessity for the German manufacturing industry to attain world markets if a surplus is to be developed for the payment of reparations and pictured the need for British labor and its employers to increase their productive efficiency in order to meet the competition of other countries. A large audience was present, and the address was broadcasted by radio.

Accounting Section and Other N. E. L. A. Meetings Next Month.—Committee meetings of the National Accounting Section, N. E. L. A., will be held in Chicago next month as follows: December 8, committees on budget, classification of accounts and annual reports, customers' records and billing methods, filing and preservation of records, fixed-capital records, merchandising accounting, payroll standardization, purchasing and storeroom accounting and securities accounting; December 9, general conference of committees and executive committee meeting. On December 10 the educational committee of the national association will meet at the Hotel Sherman, Chicago. On the same day the executive committee of the Public Relations National Section will meet at headquarters in New York; on December 11 the national executive committee will meet at the same place, and on December 12 the public policy committee. The rural electric service committee is scheduled to meet at St. Louis on December 16.

Another Engineer Governor.—George H. Dern, a mining engineer, who was elected Governor of Utah at the recent election, was the principal speaker at a luncheon of the All-Engineers' Club of Salt Lake City on November 17. Speaking of engineers and engineering work, Mr. Dern said: "If engineering is applied common sense, then we need more engineering all down the line, including governmental affairs. The engineer is trained to think straight and to be influenced by nothing except cold facts. Straight thinking and straight acting will increase governmental efficiency." He advised engineers not to stand aloof and find fault, but to render better service by getting in and helping. H. T. Plumb of the Salt Lake City office of the General Electric Company, in introducing Mr. Dern, said to him: "You are more than an engineer; you are an engineer-citizen. One state has found engineers such satisfactory governors that it has had three successive engineers as governors."

Men of the Industry

Taylor Leaves Cape & Vineyard Electric Company

Henry H. Taylor has severed his connection with the Cape & Vineyard Electric Company, Falmouth, Mass., and will be succeeded as general manager by Harding U. Greene. Mr. Taylor is one of the best known central-station men in New England. He has been identified with electrical service on Cape Cod since its inception under the late Eugene Carpenter at Falmouth in 1909 and has been general manager since April, 1923, when the company was taken over by the J. G. White Management Corporation of New York. In connection with his retirement from the company the local press paid Mr. Taylor high tribute for his "good judgment, honesty and hard work" in developing the system to its present standards.

John K. Keers, who was formerly associated with McClellan & Junkersfeld, Inc., New York, is now assistant valuation engineer of the New York Edison Company.

Elton G. Dunlap has been elected a vice-president of the Pennsylvania-Ohio Power & Light Company, with headquarters at Youngstown, Ohio. His election fills the vacancy caused by the death of Randall Montgomery. Mr. Dunlap has been connected with the Penn-Ohio company for more than twenty-five years and since 1910 has served as its treasurer.

Harry E. Tobey, who has been assistant manager of the Connersville district of the Interstate Public Service Company for four years, has gone to Vincennes, Ind., to become manager of the commercial department of three companies, the Indiana Power Company, Consumer' Power Company and the Knox & Sullivan County Power Company.

Byers Mobley of Oklahoma City has been appointed to the position of assistant superintendent of the power plants of the Oklahoma Gas & Electric System. Mr. Mobley has been associated with that organization for over a year, and previous to that connection he spent five years as traveling combustion engineer with the Green Engineering Company and two and a half years with the Northern Indiana Gas & Electric Company.

Prof. H. M. Turner of Yale University received a certificate and honorarium at the hands of Vice-president H. B. Smith at a meeting of the Connecticut Section of the American Institute of Electrical Engineers held in New Haven on November 20 for the best paper submitted by any member of the Northeastern district who had never had a paper published in the Institute *Journal* or *Transactions*. The prize-winning paper was entitled "The Transient Visualizer." At the meeting Professor Turner briefly described the origin of the ideas elaborated in the paper, the development of the apparatus and some of its applications in the field of oscillographic projection of repetitive recurrences of transient conditions in electrical circuits.

Dickey New Manager for Insull Vincennes Properties

Charles H. Dickey, Jr., has been appointed general manager for the Indiana Power Company, the Consumers' Power Company (Princeton, Ind.) and the Knox & Sullivan County Light & Power Company, which were purchased recently by the Interstate Public Service Company. The headquarters for this group will be at Vincennes,

C. H. DICKEY

Ind. Mr. Dickey has been identified with the public utility industry since he finished his university course. He was general manager of the Old Dominion Power Company, with headquarters at Norton, Va., from January, 1919, until this appointment, a month ago. In 1918 he was sales manager for the Pacific Gas & Electric Company at Fresno, Cal. He was manager during 1916 and 1917 for the Southern Counties Gas Company at San Pedro, Cal. In 1915 he acted as sales manager for the Eastern Oregon Light & Power Company at Baker City, Ore. Previous to 1915 he was associated with the Portland Gas & Coke Company, Portland, Ore.; the Grays Harbor Lighting Company, Aberdeen, Wash.; the Wilmington Gas Company, Wilmington, Del.; the People's Gas Company, Chicago, and the Merchants' Power Company, Memphis, Tenn.

J. B. Hayes, for the past year and a quarter assistant manager of the Jamaica Public Service Company, Kingston, Jamaica, has been promoted to the position of manager of the Stone & Webster properties at Fort Madison, Iowa. He was formerly the assistant superintendent of the operating department of the Nova Scotia Tramways & Power Company and before being transferred to Kingston spent a year in Boston on the engineering staff of Stone & Webster.

Louis V. Sutton, formerly connected with the Carolina Power & Light Company, has been appointed assistant general manager of the Arkansas Central Power Company, Little Rock, Ark.

H. W. Wood, formerly head of the power sales department of the Penn-Ohio Electric Company, has been appointed commercial manager in charge of all sales of the Penn-Ohio system.

LeRoy J. Clark, formerly assistant secretary of the Central Illinois Public Service Company, has been elected secretary of the company to fill the unexpired term of P. A. Erlach, who recently resigned.

Owen D. Young, chairman of the board of directors of the General Electric Company, who was associated with General Charles G. Dawes in drawing the Dawes plan of reparations and who until recently acted as agent of reparations, with headquarters in Berlin, returned to New York November 20 aboard the White Star liner *Olympic*.

B. F. Clingerman has been appointed resident electrical engineer for the Byllesby Engineering & Management Corporation, with headquarters at Minneapolis. Mr. Clingerman was formerly connected with the Mobile Electric Company and the Mountain States Power Company. He is resuming his connection with the Byllesby organization after several years' association with the Goodrich Rubber Company.

E. H. Beil, for many years an official of the Penn-Ohio system, has resigned as manager of light and power of the Penn-Ohio Electric Company to become associated with Stevens & Wood, management and engineering firm of New York and Youngstown. Mr. Beil's affiliation with the Penn-Ohio system covers a period of thirty-one years.

Homer Carson, who has been connected with the Shenandoah district of the Iowa Service Company, has been appointed superintendent of the Lee Electric Company at Corning, Iowa, to succeed A. A. Scheel, recently resigned.

Lennox Birckhead, who has been associated with the Consolidated Gas, Electric Light & Power Company of Baltimore since 1913, has been appointed assistant electrical engineer of the company. Mr. Birckhead was graduated from the University of Pennsylvania with the degree of bachelor of science in electrical engineering and immediately after entered the test department of the Consolidated company. He spent fourteen months in that branch of the organization before being transferred to the electrical engineering department, where he remained until the present time.

Lloyd S. Purcell, formerly assistant secretary and assistant treasurer of the Dubuque (Iowa) Electric Company, is now connected with the New York office of the Albert Emanuel Company, Inc., former owner of the Dubuque property. Mr. Purcell, who also served as assistant treasurer of the Eastern Iowa Electric Company, was an employee of the Leavenworth (Kan.) Light, Heat & Power Company when it was taken

over in 1922 by the Albert Emanuel Company and made a unit of the Kansas Electric Power Company. Subsequently he was transferred to the Dubuque utility, which has recently been purchased by the Utilities Power & Light Corporation.

New York Edison Elects Three New Vice-Presidents

At the meeting of the board of directors of the New York Edison Company held November 25 the following elections were made: Thomas E. Murray, senior vice-president; John W. Lieb, vice-president and general manager; Arthur Williams, general commercial manager since 1915, vice-president in charge of commercial relations; Philip Torchio, chief electrical engineer since 1905, vice-president in charge of electrical engineering, and Harry M. Edwards, auditor since the organization of the company in 1901, vice-president in charge of accounting.

James L. Gray has been elected auditor of the Central Illinois Public Service Company to succeed the late R. A. Crews.

John L. Dickinson of Lawrenceville, Ill., has assumed managerial duties at the Bridgeport (Ill.) office of the Central Illinois Public Service Company.

Le Roy Speights, formerly chief of the Electrical Bureau of the city of Richmond, Va., recently resigned to affiliate himself with the Virginia Railway & Power Company.

George T. Smith, formerly associated with the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., is now engaged in electrical design work for Fairbanks, Morse & Company, Indianapolis.

T. C. Capistron, formerly assistant chief load dispatcher of the New England Power Company, Millbury, Mass., has been promoted to the post of supervisor of substations, with headquarters at the main office of the company in Worcester.

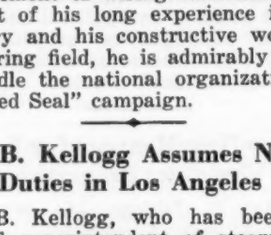
F. J. Gunther, formerly superintendent of operation in the Beatrice district of the Nebraska Gas & Electric Company, has been appointed to the newly created position of superintendent of operation in the Norfolk district.

L. G. Kepler, recently connected with the Maryville (Mo.) Electric Light & Power Company, has been appointed manager of the Plattsmouth district of the Nebraska Gas & Electric Company, both these properties being subsidiaries of the Continental Gas & Electric Company. Mr. Kepler has been identified with several of the utilities controlled by the Continental since he came to the United States a year ago from Chile.

H. B. Kirkland, vice-president of the American Wiremold Company and president of the Electrical League of Hartford, will join the headquarters staff of the Society for Electrical Development December 1. He will supervise the society's general activities affecting wiring, and particularly the "Red Seal" plan to "promote adequate wiring for convenient electrical service in the home." Mr. Kirkland will co-ordinate the recommendations of the "Red Seal" advisory committees, appointed by the various national associations, and will be available to assist national organizations in the development of other co-operative programs for the advancement of wiring standards. On account of his long experience in the industry and his constructive work in the wiring field, he is admirably fitted to handle the national organization of the "Red Seal" campaign.

R. B. Kellogg Assumes New Duties in Los Angeles

R. B. Kellogg, who has been appointed superintendent of steam generation of the Southern California Edison Company, Los Angeles, became identified with that organization about a year ago, when he entered its service in the capacity of assistant operating engineer. Previous to that time he had had considerable experience with various manufacturers of prime movers and steam machinery and was chief engineer in charge of the installation and operation of steam machinery in marine and naval service.



R. B. KELLOGG

Thomas W. Bowry, for thirty-four years in the service of the city of Richmond, Va., has been appointed to take over the duties in the city Electrical Bureau performed by Chief of Bureau Le Roy Speights, who recently resigned. The title of bureau chief has been abolished.

R. C. Broach, a native of Atlanta and formerly in the general sales department of the Heine Boiler Company at St. Louis, has been appointed Southeastern district manager for this company, with offices in Atlanta. The Southeastern territory comprises eastern Tennessee, North and South Carolina, Alabama, Georgia and Florida.

P. A. Erlach has been appointed comptroller of the Northern Indiana Gas & Electric Company, Hammond, Ind., to succeed B. P. Shearon, who recently resigned. Mr. Erlach has been connected with the Central Illinois Public Service Company for the past twelve years, and since May 1, 1919, he has been secretary in charge of accounting and tax and general financial matters. Prior to that time he served for several years as general auditor of the company. Mr. Erlach is active in the work of the National Electric Light Association and the American Gas Association, having served on many important committees in those organizations.

Harry E. Brooks, who four years ago as vice-president and general superintendent organized the Badger Utility Company, Pulaski, Wis., has resigned his position with that company to become president and general manager of the Wittenberg Light & Power Company and its subsidiary companies.

D. E. Stultz of Frederick, Md., has been appointed superintendent in the Winchester (Va.) territory of the Potomac-Edison Company, succeeding C. C. Moler, transferred to Hagerstown, Md. Mr. Stultz has been stationed in the Berkeley Springs (W. Va.) territory.

F. L. Hill, superintendent of the customer-ownership department of the Penn Public Service Corporation, has resigned and is now affiliated with the Laclede Securities Company at Chicago. Mr. Hill entered the service of the Public Service Corporation two years ago and immediately organized what was then termed the securities department, the name later being changed to the customer-ownership department.

Royal A. Pickup, who has been a member of the engineering department of the Erie (Pa.) Lighting Company, has been appointed superintendent of the Corry district of the Venango Public Service Company, Johnstown, Pa. Mr. Pickup brings to his new office wide experience in the electrical industry. A graduate of the Bliss Electrical School, Washington, D. C., and later an instructor on the staff, Mr. Pickup subsequently entered the service of the St. Lawrence River Power & Transmission Company as assistant superintendent of the meter and test department at the Massena Works of the Aluminum Company of America. After taking up construction work in several of its branches he was appointed manager of the Dixie Light & Power Company at Walton, Ky., retaining this position until he joined the engineering forces of the Erie Lighting Company.

Obituary

Charles Orme Bastian died in London, England, October 29, in his fifty-fifth year. Mr. Bastian was a pioneer of modern methods of electric heating and the inventor of the Bastian water heater and thermal storage geyser.

H. J. Gorke, one of the prominent electrical supply jobbers of Syracuse, N. Y., died at his home in that city November 14 of pneumonia. A German by birth, Mr. Gorke came to America as a young boy, establishing his residence in Syracuse in 1887. He entered the electrical industry as finance manager of the Electrical Engineering & Supply Company in 1891, one year later being appointed general manager. Starting the jobbing business in 1897, he organized the electrical jobbing firm known as H. J. Gorke, Inc. Mr. Gorke had for many years been a member of the Electrical Supply Jobbers' Association.

Commission Rulings

Changing Schedules and Refiguring Former Bills.—In a complaint brought by B. A. Railton & Company against the Commonwealth Edison Company reparation was sought on the allegations, first, that the complainants had for several years been purchasing electric service from the respondent under rates known as "A" and "B" and that during this time their consumption was such that their bills would have been less under another schedule known as "C," and, second, that they had been discriminated against because the company had advised certain others of its customers in a like position with themselves to change from rates "A" and "B" to rate "C," but had not so advised them. The Illinois Commerce Commission found (1) that a public utility is under no legal obligation, other than statutory obligations as to the publicity of rate schedules, to see that a customer is at all times on the most favorable rate, (2) that an electric utility should not be required to refigure a customer's bills for the previous year on the basis of a new rate and, if any saving is shown, refund the amount thereof to the customer, provided that the circumstances surrounding and controlling the customer's consumption are within the customer's knowledge and control and the practice of the utility in this regard is fair and reasonable. (For other decisions of the Illinois Commerce Commission in cases involving the relative advantage of different rate schedules to consumers see ELECTRICAL WORLD for July 5, page 40, and May 17, page 1029.)

Conditions Governing Rural-Line Maintenance.—The Wisconsin Railroad Commission observed in a case which concerned the rural lines of the Northern States Power Company that although the higher maintenance cost on rural lines results from the limited number of consumers that can be served from a single unit of length, it does not follow that the respective costs of operating and maintaining urban and rural distribution systems per customer will be in proportion to the different lengths of conductor involved. "There are other factors," said the commission, "that enter which make the costs of rural operation exceed the result arising from any such proportion. In the first place, the rural lines are much more exposed to the action of the elements, and the smaller sizes of transformers commonly used on rural lines are especially liable to damage from lightning. Sleet and wind damages are also likely to be much more disastrous to rural lines than to city lines. The element of distance also enters into all operating and maintenance work on rural lines, and the idle time of repair and trouble men going and coming is an appreciable item of increased expense, as is also the cost of transportation of men and equipment. With the longer lines and increased equipment per consumer on rural lines the utility is liable for larger renewal charges and taxes per customer or per unit of sales than in the city. We have already commented upon the losses occurring on rural lines because of the necessity of individual transformers. It is also true that the line losses chargeable to rural consumers are higher per consumer on rural lines than on urban lines."

Recent Court Decisions

Value of Portion of Property of Utility Operating in Several States to Be Taxed in One.—In Floyd vs. Manufacturers' Light & Heat Company the Ohio Supreme Court enunciated an opinion establishing the principles to be followed in fixing the true value in money of that portion of the property of a utility operating in several states to be assessed and taxed in Ohio. The court found as a matter of law that the income in Ohio from the utility company's property should be considered in relation to the entire value of the utility's property and not with reference alone to its separate property in that state. (144 N. E. 703.)*

Explanation of "Present Value."—In a report filed by C. D. Dorsey, standing master in the United States District Court for the Northern District of Georgia, on a rate case (Georgia Railway & Power Company vs. Railroad Commission of Georgia) a statement of the reasoning supporting his findings as to "present value" appears. It is as follows: "If I know the cost or value of 2,000 bales of middling cotton is $100,000 in 1914, and that the price of middling cotton has advanced 60 per cent in 1924 over the 1914 value, I must conclude that the value of 2,000 bales of middling cotton in 1924 is approximately $160,000. If I know it cost $100,000 to construct a building or a plant in 1914 and that it would cost in 1924 to reproduce such a building or plant $160,000, measured by prices of labor and material at this time, I must conclude that the present value of such a building or plant is, or at least approximates, $160,000, less depreciation, rather than $100,000. And these, it seems to me, are the principles which should be applied in fixing the present value of the properties of public utilities in rate cases. To consider in 1924 and give such weight as may be just and right to the original or historical cost of a plant built in 1914 and prior thereto is proper under the law. To use such historical cost or the cost of construction as of 1914 as the present value of the plant, while admitting that cost and prices, and therefore values, have advanced 60 per cent and are stabilized on that level, is an entirely different thing and contrary to law as laid down by the Supreme Court."

*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

Water-Power Rights Under Provisional Charter in Quebec Are Upheld.—The right of the United Manufacturing Company, under a provisional charter granted in 1910, to the exclusive use of a section of the St. Maurice River was upheld recently in the Superior Court of Quebec in a judgment ordering the St. Maurice Power Company, Ltd., which holds a lease of the section in question from the provincial government to cease all operations which may interfere with the plaintiff company's charter rights. The decision is the outcome of a dispute of major importance in power development circles involving constitutional questions regarding the nature of rights in a river conceded by a provisional charter. For this reason the Attorney-General of Quebec intervened, taking up the case of the St. Maurice Power Company, Ltd., which had maintained that it was empowered by a lease from the province to proceed with power development in the region between Des Forges Rapids and Grès Falls.

Company Furnishing Power Through Consumer's Own Equipment Has No Duty of Continuing Inspection.—Hoover vs. Minnesota Electric Light & Power Company was a suit to recover damages on the plea that defendant's high-tension lines supplying power to plaintiff's own wiring system had, because of their improper insulation and maintenance, caused injury to an employee of the plaintiff who came in contact with them while working on a tank. Damages were granted in the trial court, but the Supreme Court of Oklahoma has reversed the finding and remanded the case on the ground that the power company owed no duty to the plaintiff's employee. "Where an electric power company furnishes current to a refining company through wires and appliances constructed and owned by the refining company," the Supreme Court says, "there is no duty of continuing inspection upon the electric company to see that such wires and appliances are at all times in safe condition to receive such current. . . . So long as it is not chargeable with some defect therein, it may assume that such safety will be maintained. . . . A refining company which has constructed a system of wires, poles and appliances upon its premises to receive and transmit electric current, and has connected such system with the wires of a power company, and takes the electric current therefrom through its own system of wires and appliances, owes to its employees the duty of inspecting such wires and appliances so that injury may not occur to such employees when properly coming in contact therewith, but no such duty is owed to such employees by the furnisher of such power. . . . In such a case the ownership or control of the wires and appliances is the test of the duty, and where there is a conflict in the evidence as to such ownership or control the question is one for the jury. The liability of the power company, if any, must be predicated upon its knowledge of the defective condition in case of wires or appliances not owned nor installed nor controlled by it." (229 Pac. 285.)

Manufacturing and Markets

Patent Conflicts Avoidable

Trade Associations Perform a Real Service in Providing for Interchange of Rights

IN THE electrical as in other industries many patents are registered each year in the United States, and the virtual monopoly which a patent provides has been a prominent factor in the tremendous development of the industry. Very frequently patents are kept from use by conflict which is avoidable, but any plan providing for a compulsory license such as has been talked about would react unfavorably and block progress. The elimination of trade friction caused by conflicting patents would, none the less, be of great help, and in this work trade associations have performed a real service to the industry. A report covering this subject has just been prepared by the National Industrial Conference Board. The establishment of numerous distinct legal monopolies over various devices and articles in an industry is frequently a serious obstacle to the improvement of processes and products, the board finds. One concern's patent may be "blocked" by another's, and neither may be able to develop its full competitive strength. Or each competitor may have some special advantage in one stage of production but be compelled to forego the best practice in other stages. It frequently happens that while each concern benefits a little by its own exclusive rights, every concern loses more than it gains in this way by the exclusive rights represented by the numerous patents of its competitors. Trade associations have worked out systems for interchanging patents within an industry which tend to remove these incidental handicaps which patent privileges place upon industrial progress.

Weave of Braids of Code Wire to Be Standardized

RUBBER-COVERED wires in sizes No. 8 B. & S. gage and smaller will after Jan. 1, 1925, have braids woven to meet a specification recently adopted in order to use the underwriters' labels. This has been announced by the Underwriters' Laboratories to wire manufacturers subscribing to the label service. This new specification covering the braid makes available for the first time means for specifying braids as to closeness of weave and covering capacity. Its general intent is to insure that the surface of the rubber insulation is well covered where wires are twisted or bent as well as when they are lying straight.

No action by inspection authorities, contractors or users of rubber-covered wires is necessary or desired in this connection, since the operation of the label service program will insure the prompt and general application of the new specifications after January 1. Present stocks of labeled wire made, purchased and used in good faith complying to requirements now in effect will be rated as standard as heretofore. Much of this wire satisfies all demands of the new specifications.

Use Utility Employees to Sell Ranges

Electrical Cooking Can Be Promoted Through the Efforts of Central-Station Employees Who Own Ranges and Can Tell Their Friends All About Them

By GEORGE A. HUGHES
President Edison Electric Appliance Company, Chicago

IN THE electric range promotional work done so far not enough thought and effort have been directed toward developing the influence of the utility employees. Executives have talked, argued and discussed the merits of this type of cooking. The leaders of the industry know the benefits of electric cooking because much work has been done to convince them, but full use has not been made of company employees as salesmen.

An estimate for the first nine months of 1924 shows that 60 per cent of the ranges sold have been disposed of east of the Mississippi River. This is a startling indication of the growth in sales since back in 1914 fully 95 per cent of the ranges were sold west of the Mississippi, and mostly on the Pacific Coast, where rates were favorable. In spite of this growth, however, the fact remains that the electric cooking field is as yet hardly scratched. Since so much has been accomplished with the employees left out of the picture almost entirely, it is worth while to consider the effect of the buying public that will be exerted by giving utility employees an important part to play.

With electric ranges at their present stage of development, undoubtedly the best way of spreading experience is by word of mouth. Though the industry itself may have reams of statistics on the operating costs of ranges, this information is almost valueless unless broadcast among the central-station customers. The average layman is still skeptical concerning electric range operation. What better means has the industry of selling more ranges and more electrical energy than by encouraging the enthusiastic wife of a central-station employee who is a range owner to tell her neighbors about the operating costs?

PROMOTE EMPLOYEE RANGE OWNERSHIP

Central-station companies will do well to "tie in" with the offers of those manufacturers who give utility employees courtesy discounts. Because range manufacturers and central stations are really in the same business — selling kilowatt-hours — more central stations should take advantage of these offers. Of course, the idea of allowing discounts to utility employees is not new. It has been done by some companies for more than ten years. But it would seem, with the present rate of growth in the use of ranges and the experience obtained from the field, that even greater progress could be obtained were more knowledge of operating economy disseminated through personal contact. In fact, discounts to persons whose daily business it is to sell electric ranges

have been found very beneficial in promoting their use.

An experienced range manufacturer can easily detect from the range sales in any one locality how intimate the personal relationships of range-owning utility employees can be with their neighbors. It goes without saying that a person interested in buying an electric range will confer with the owner of one. The discussion will include undoubtedly the expense of operation. If the utility employee is in a position to give these figures from his own experience, he can render service to his company in building up its load and will receive credit for any sale due to his effort. More central-station managers should realize the opportunities in this direction, and more manufacturers should press this very natural approach to the waiting market.

Department of Commerce Annual Report

Secretary Hoover Points Out the Prosperity of Business—Elimination of Waste—Trade Associations Rightfully Conducted Are of Vital Importance

IN A REVIEW of the economic progress of business conditions during the year ended June 30, 1924, Secretary Hoover, in his annual report as head of the Department of Commerce, draws conclusions as to the prosperity existing throughout the business world at that time that are encouraging to industry. He further points out that European stabilization, which the Dawes plan may be expected to achieve, will bring about a revival in world trade and increased consumption of commodities. In this increased trade the United States is bound to share. Now comes the announcement by Owen D. Young, who took up the task of putting the Dawes plan in operation and who has just returned from Europe, that the machinery of the plan is functioning smoothly.

In the second part of his report Secretary Hoover strikes as a keynote "the elimination of national waste." Under this head Mr. Hoover reviews the accomplishments of the department during the first three years of the present administration, including seasonal construction, coal, superpower, standardization, simplified practice, etc. Trade-association activities are also discussed from the same angle. "A definite, constructive national program has been developed for the elimination of waste in our economic system," says Mr. Hoover. In this connection he points out that there are wastes which arise from speculation and overproduction during booms. This is probably due largely to a lack of statistics covering manufacturing operations.

Investigations of the bituminous-coal industry made early in the present administration revealed the high instability of this industry and the fact that it was functioning at a great national loss. Much good was accomplished, and Mr. Hoover says: "It is true that during the past few months the industry has been somewhat demoralized by the large stocks of coal accumulated in anticipation of a possible strike last spring and by the lessened demand during the summer. The broad result of gained stability, however, has been that the public has received its coal during the last fiscal year at the lowest price of any year since before the war."

In the section of the report dealing with trade associations Mr. Hoover says: "One of the most important agencies through which the elimination of waste may be promoted is the trade association. It is true that a small minority of these associations have been in the past used as cloaks for restraint of trade by such activities as open-price associations and other attempts to control distribution or prices. It is equally true that the vast majority of trade associations have no such purpose and do no such things. The dividing line, however, between what activities are in the public interest and what are not in the public interest is not today clearly defined either by the law or by court decision.

In consequence of some recent decisions of the courts many associations are fearful of proceeding with work of vital public importance, and we are losing the value of much admirable activity. At the same time we are keeping alive the possibility of wrongful acts. It is imperative that some definition should be made by which an assurance of legality in proper conduct can be had, and by which illegality or improper conduct can be more vigorously attacked."

Business Conditions

GENERAL improvement of business continues throughout the country, industrial-plant operations have improved, there is a greater demand for maintenance supplies, and inquiries for material and equipment are increasing. There is a sustained activity in the market that has not been evident for several months. However, few large orders have yet been placed on account of the time lag between inquiries and orders of large equipments. Motor sales, which have been slow all year, are now also showing improvement.

Reports of steel production by independent steel mills show that orders are larger than at any time since April. The statement of Owen D. Young, who has just returned from Europe, that the Dawes plan is working out successfully lends a further element of optimism to the business situation.

In New England industrial buying has improved, power transformers are moving actively, and motor sales are showing a healthy increase. Inquiries by utilities and industrial plants for equipment and material are increasing in the New York district, and supply material is moving actively. In the Southeast, general conditions are very satisfactory, many industrial plants are now on full-time operation, and building activities are continuing unabated. Considerable interest in large centers in this territory is being displayed in electric refrigerating machines. Good orders received in the Middle West indicate the improving trade conditions. Central-station companies in this district are active in making numerous extensions. On the Pacific Coast building construction is active, with a larger movement of schedule material than at any time this year.

Germany Supplies 45 per Cent of October Electrical Imports

THE total imports of electrical merchandise for the month of October as issued by the Bureau of Foreign and Domestic Commerce show that Germany contributed 45 per cent of all electrical imports to the United States. The value of the total imports was $293,057, those supplied by Germany having a value of $133,472. The majority of the apparatus imported covers small supply lines, there being no export of electrical machinery except from Switzerland to the value of $118. The imports from the other important coun-

tries were, England, $55,249, of which more than half the amount was radio apparatus and 20 per cent carbons; France, $8,810; Austria, $15,839, two-thirds of which was for carbons; Hungary, $21,830, more than two-thirds of which was metallic filament incandescent lamps; Czechoslovakia, $10,290, divided equally between table lamps, incandescent lamps and lighting fixtures, and Japan, $37,428, about 95 per cent of which was christmas-tree lamps.

Non-Ferrous Metal Market Sales Good—Prices Firm

THE non-ferrous metal market has been fairly active this week, and prices have registered moderate advances. Many inquiries for copper have been received and fair sales have been made at 13¾ cents, but most producers are now asking 14 cents, especially for forward shipments. Export sales have been good and there has been a slight advance in the London market, with a corresponding effect on the domestic situation. The increase in mine production of copper for October was over 5,000 tons, but this does not seem to have had the slightest unfavorable effect on the market.

The demand for lead is quiet, but

NEW YORK METAL MARKET PRICES

	Nov. 19, 1924 Cents per Pound	Nov. 26, 1924 Cents per Pound
Copper, electrolytic	13¾–14	14
Lead, Am. S. & R. price	8.65	8.65
Antimony	15	14½
Nickel, ingot	29–30	29½
Zinc, spot	7.25	7.25
Tin, Straits	54¼	54½
Aluminum, 98 to 99 per cent	28	28

the American Smelting & Refining Company's price remains at 8.65 cents. Some business has been placed with outside interests at 9 cents, and the total volume of sales, though not very large, is still in excess of offers. The consumption of lead is very good, but as present needs are covered by contracts the immediate trading is slow. The zinc market is firm with a good demand, especially from the galvanizers. With more tin offered for sale abroad than was purchased, the price weakened somewhat but is now holding firm at 54½ cents.

Industrial Buying Improves in New England

A MARKED improvement in apparatus sales is reported from New England this week. Power transformers for industrial-plant service are moving actively, one distributor selling 1,000 kva. in the last few days. A New Hampshire mill bought a 600-kva. bank last week. Motor sales are showing a healthy increase, and among the purchases of industrial plants were one of twenty-four motors aggregating 120 hp., a fifty-motor sale totaling 300 hp. and a twenty-five-motor sale aggregating about 200 hp.

Cenral-station buying is well sustained, and one company in Massachusetts is in the market for about $100,000 worth of lead-covered cable. New England building contracts last week totaled $5,528,000, a gain of $150,000 over last year, this being the best record for that particular week with one exception for twenty years. Contractor-dealers are buying in fair volume, but both dealers and jobbers are holding purchases close to current needs. Electric-appliance sales are rapidly increasing, one central-station syndicate reporting a total of $18,414 for the latest week, against $9,349 four weeks ago.

Conditions in Southeast Good—Industry and Building Active

GENERAL conditions in the Southeast continue to be very satisfactory, with all of the large industrial plants on full-time operation and building activities unabated. Electrical jobbers report orders from central-station companies as satisfactory, though the volume shows a falling off from the past few weeks. This lull is considered only temporary. Orders from the small towns and rural communities show a marked improvement, this being the result of the marketing of the excellent crops. This is further reflected in the movement of farm-lighting outfits, which is active, and good stocks are maintained in the territory in anticipation of continued good sales.

Considerable interest in the large centers is displayed in electric refrigerating machines, with a noticeable tendency on the part of builders to equip new apartment houses throughout with this specialty. Several good jobs of this nature have been closed in the past few weeks. Vacuum-cleaner sales are reported as satisfactory, though no general increase over the same period last year is to be noted. However, one manufacturer's agent states that October business was the best for any month during the past two years. The demand is the greatest in the Carolinas and Florida, but prospects for the section as a whole are bright and good stocks are in the warehouses.

Equipment Inquiries Increasing in the New York District

MANUFACTURERS continue to report increasing inquiries by utilities and industrial plants for all types of equipment and material, and the market is generally much more active. Few large orders have yet been consummated as this requires time, but the day-to-day activity of the supply market, which has shown a very good increase in business, is indicative of the general condition. Motor sales have also improved, and despite the poor fan season of this year, some fan orders for next year which are now being placed show the confidence of the buyers.

An increased demand is noted for conduit and wire—a result of the increased building construction activity. There is also at this time a volume of building projects being offered for estimates that is out of all proportion to the volume usually met with at this time of the year. Permits for many of these jobs were issued earlier in the year, but they were not previously estimated on. Appliances, blowers and washing machines are selling well, but heaters, on account of the mild weather, are moving slowly. Prices are generally steady.

Good Orders in Middle West Indicate Improving Trade

REPORTS received from electrical manufacturers and jobbers in all parts of the Middle West appear to indicate that business is definitely on the upswing and will stay there. Scattered reports show that numerous extensions to present central-station systems are being made. Distribution equipment is much in demand, and one manufacturer reports receiving a large order for transformers, among which were three 5,000-kva. and three 3,000-kva. machines. There has been an active demand for pole-line hardware in the Chicago district and more particularly in the Northwest territory. The demand for motors has accelerated somewhat, one manufacturer reporting having received an order for a quantity of 10-hp. motors.

A considerable volume of business has been obtained by jobbers in the hotel and restaurant electric service equipment line. Although this year's volume of general electrical business is reported to be well ahead of last year's figures, this particular line has up to this week been rather quiet. Washing-machine sales have increased, and there has been an unusually large demand for portable lamps. Prices are generally firm. It is understood that the 3 per cent advance in code wire prices last week was due to the recent changing of the underwriters' specifications as to braiding. The radio show held at Chicago has met with much success, the total business closed by exhibitors having been $6,500,000.

Building Construction Active on the Pacific Coast

A LARGE volume of building construction is under way on the Pacific Coast. Indicative of this is the statement of a well-known manufacturer of schedule material, who maintains a warehouse in San Francisco for Pacific Coast distribution, that his business for the first twenty days of November exceeded the business for any previous entire month this year. Retail business, however, is slow despite frequent inducement sales. Copper wire has again increased in price, and although other prices are steady, the feeling prevails that advances are near.

Power-company business is rather quiet. Recent orders placed are one for 1,000 high-tension insulators and another for 50,000 pins. Electric ranges are expected to attain record sales now that the danger from the drought has passed and dammed-up business is again flowing. Lamp-cord business is changing its character, with the influence of the radio demand, and there is a growing emphasis on individuality of color in textures. The recent committee meetings of both the Commercial Section of the National Electric Light Association and the California Co-operative Campaign have assured constructive policies in the Pacific Coast section for 1925 business.

Activities of the Trade

Recent Installations of the New General Electric Compressors

Among the installations which have been made of the new General Electric multi-stage centrifugal compressors are four 25,000-cu.ft., 35-lb. machines for the Public Service Corporation of New Jersey; one 8,000-cu.ft., 70-lb. machine for the New Bedford (Mass.) Gas & Electric Company; two 8,600-cu.ft., 16-lb. machines for the Utica (N. Y.) Gas & Electric Company; an 8,300-cu.ft., 16-lb. machine for the Metropolitan Utilities District of Omaha; two 45,000-cu.ft., 25-lb. pressure units for the Mystic Iron Company, and a 6,900, a 12,000 and an 8,200-cu.ft. machine for pressures of 27, 63 and 28½ lb. respectively, for the Gillette Safety Razor Company, Boston.

Manufacture of High-Amperage D & W Fuses Discontinued

The manufacture and sale of D & W fuses of capacities from 650 amp. to 1,000 amp. inclusive, at 250 and 600 volts rating, will be discontinued on December 1, 1924. These fuses are manufactured by the D & W division of the General Electric Company. This action is being taken because of the small demand during the past few years and also because inclosed cartridge fuses of capacities greater than 600 amp. have never carried the approval of the Underwriters' Laboratories. Circuit breakers are being recommended as substitutes.

A. M. Little Company Organizes as Wholesale Distributor

The A. M. Little Company, Inc., Water and Grape Streets, Syracuse, N. Y., has been organized as a wholesale distributor of electrical supplies and appliances. The company has established a policy of confining its activities to certain selected lines of proved quality. It is the intention to add new ones from time to time as conditions warrant or customers suggest, but there will be no duplication and therefore no divided effort. The company intends to carry a combination of stocks of lines that will include material in general demand by the trade and best obtained through a distributor.

At the present time the company is distributor of the lines manufactured by the following companies: The American Jobbers' Supply Company, the American Wiremold Company, the Ansonia Electrical Company, the Boston Woven Hose & Rubber Company, the Chicago Fuse Manufacturing Company, the Curtis Lighting, Inc., the Hart & Hegeman Maunfacturing Company, the Illinois Electric Porcelain Company, Landers, Frary & Clark, Mazda lamps, the New York Insulated Wire Company, the Steel City Electric Company, the Thomas & Betts Company, the Wheeler Reflector Company, the Yale Electric Corporation and the Youngstown Sheet & Tube Company. The personnel of the company is: A. M. Little, president and treasurer; F. S. Smith, vice-president, and P. B. Eddy, secretary.

Carney Company Completes List of Distributors

B. J. Carney & Company, Grinnell, Iowa, with a producing office at Spokane, Wash., and a pole concentrating and treating plant at Minneapolis, have chosen as their district managers William Mueller, 115 South Dearborn Street, Chicago, and J. A. Navarre, Spitzer Building, Toledo. In addition the following local agents have been appointed: W. J. Mulholland, Commercial Trust Building, Philadelphia; R. R. Glover, Electric Building, Cincinnati; Arthur H. Abbott, 88 Broad Street, Boston; J. J. Miley, 30 East Forty-second Street, New York City, and J. B. Eaton, Rochester, N. Y.

Gibb Instrument Company Changes Name

The Gibb Instrument Company, Bay City, Mich., has changed its name to the Gibb Welding Machines Company. The company announces that this change is in name only and denotes no change in organization. As the company no longer makes instruments but is engaged exclusively in the manufacture of electric welding and heating machines, the new name was adopted as more exactly descriptive of the product.

Pacific Electric Manufacturing to Build New Factory

The Pacific Electric Manufacturing Company, San Francisco, manufacturer of a complete line of high-tension equipment, will erect a new factory building at Keith Street and Donner Avenue in the new industrial district of the city. The main building will be 100 ft. x 300 ft. in size and of reinforced-concrete construction. The company is now at 827 Folsom Street, where it has entirely outgrown its present quarters.

St. Louis Rubber Cement Company Builds Factory Addition

A new building, 75 ft. x 135 ft., has just been erected by the St. Louis Rubber Cement Company at 3951 Laclede Avenue, St. Louis. This building is to be devoted to the manufacture of a complete line of friction and rubber tape for the electrical and automotive industries. The business is now being conducted by the third generation of the family, which has the distinction of having made the first rubber cement in the history of the world.

Transmission Tower Fabricating Appoints New Representatives

In addition to the sales representatives which the Transmission Tower Fabricating Company of Chicago has in Chicago, Indianapolis, Columbus, New York City, St. Louis and Minneapolis, three new representatives have been appointed: J. W. Fraser & Company, Charlotte, N. C., for North and South Carolina; the Industrial Supply Company, 714 Brown Marx Building, Birmingham, for Tennessee, Alabama, Mississippi and Georgia, and the Globe Electric Supply Company, 1843 Wazee Street, Denver, for southern Idaho, Wyoming, Utah, Colorado and northern New Mexico. These representatives are provided not only for sales work but to act in an advisory capacity to utilities on the use of transmission line steel.

The National Council of Lighting Fixture Manufacturers, Cleveland, announces a change in the address of the headquarters office from the Gordon Arcade Building to 424 Cleveland Discount Building, 811 Superior Avenue.

The Square D Company, Detroit, manufacturer of electrical safety devices, has appointed Russell Murphy as district sales manager for the Chicago district, with offices at 949 Otis Building, 10 South La Salle Street, Chicago. Mr. Murphy was formerly in charge of the Square D Company's Milwaukee territory and succeeds R. J. Parisian, who has been promoted to be special representative of the company.

The Champion Electric Company, 3711 Forest Park Boulevard, St. Louis, has been organized and incorporated by E. P. Fritschle and associates to manufacture motors in the single-phase, two-phase, three-phase and split-phase types previously manufactured by the Champion Shoe Machinery Company, which company owns and controls the new enterprise.

The Laco-Philips Company, 131 Hudson Street, New York, manufacturer of lighting specialties, announces that it is the owner of the duly registered trademark "Laco." The company makes this announcement because another firm was also using the word and so infringing this trade mark, but the other company has now agreed to discontinue its use.

The Automatic Electric Heater Company, Warren, Ohio, has recently equipped the Ford motor ship, *Henry Ford II,* with forty-two electric steam radiators. The company has also installed two large electric "Sepco" water heaters on this boat.

The Machen Electric Manufacturing Company, Inc., 4639 East Thompson Street, Philadelphia, announces that George B. Comfort, for some years production manager of the Miller Lock Company, Philadelphia, has joined the organization as treasurer and factory manager.

The Aladdin Manufacturing Company, Muncie, Ind., manufacturer of "Aladdin" lamps, is now manufacturing a new desk lamp combining the flexible arm and green-glass shade features.

New Equipment Available

High-Capacity Fuse

An extra-heavy capacity fuse which will interrupt short-circuit currents as high as 10,000-amp. has been developed by the Hi-Voltage Equipment Company, 3005 Croton Avenue, Cleveland. This fuse operates on the same principle as the company's standard fuse and can

200-AMP. HIGH-CAPACITY FUSE

be fused up to 200 amp. It is capable of clearing the circuit very rapidly with the same speed and with positive and reliable action every time, and the maintenance cost is said to be very low. After the fuse has blown there is no possibility of leakage of current either through or over the fuse tube, because there is then an actual air gap in the line. The fuses are built for all voltages up to and including 132 kv.

Automatic Arc-Welding Travel Carriage

For simplifying the welding process in production work where similar welds are made repeatedly on the same kind of articles, a travel carriage, in a self-contained unit, has been developed for the automatic arc-welding of straight seams by the General Electric Company. It consists of an automatic welding head, necessary control, travel motor and wire reel support, all mounted on a suitable framework and provided with wheels for rolling along a track. The welding head and control are mounted on the apron of the carriage and feed the electrode wire from a reel to the arc. This reel is carried by supports attached to the carriage frame.

The travel carriage is controlled electrically by means of push-buttons, so that once the work is set up the operator may throw the system to automatic position, thus confining the control of both welding head and travel motor to one push-button. Control of the welding head and travel motor is so interlocked that should the arc fail for any reason, the travel motor will stop without overtravel, the arc will re-establish itself and the travel motor will restart, all without attention from the operator, thus insuring a continuously welded seam. An adjustable time-limit switch stops the motor at the end of the weld and the carriage is returned to the starting position, either by hand or electrically by manipulating the push-buttons. The carriage can be provided with an oscillator to be used when welding heavy plate.

Combination Junction Box and Automatic Starter

A combination junction box arranged for use with the new line of Sundh automatic starters and so designed that it can straddle a standard junction box and permit the wiring to be practically finished while the inside construction work is going on has been developed by the Sundh Electric Company, Newark, N. J. The use of this junction box is intended to prevent damage to the control apparatus during construction, as all wiring, including push-button circuits can be completed and it is unnecessary to install the control apparatus until the construction work is finished. The main frame or brackets of the junction box support the automatic switch and overload relays, which are suspended therefrom. The inclosing pot is made to meet the two conditions when using either air-break or oil-type switches.

"Edgewound" Resistor

A ribbon-type resistor, wound on edge, has recently been developed by the Monitor Controller Company, Baltimore, and is intended for service where cast-iron grids would otherwise be employed. The resistor unit consists of a high-resistance alloy ribbon, having a negligible temperature coefficient of resistivity, wound on edge in helical form and mounted on a steel-reinforced porcelain support which passes through the entire length of the unit, supporting and separating every convolution at two diametrically opposite points. The ribbon can operate at any temperature up to red heat without sagging or injuring the resistor.

Two forms of clamps are provided for making taps and end connections. One is a bridging clamp which makes solid mechanical connection between two adjacent units as shown in Fig. 1 and which serves as a terminal when the units are connected in parallel and

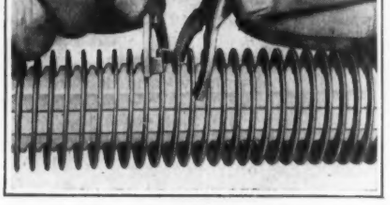


FIG. 2—PORTION OF RESISTOR UNIT SHOWING USE OF TAP CLAMP

also as an end tap, if desired, when the units are connected in series. The other may be used for either of two purposes—as a terminal clamp or as a tap as shown in Fig. 2. The resistors are made in standard elements and mounted in frames. On the basis of air temperatures as permitted by the underwriters, an "Edgewound" resistor unit will dissipate 75 watts per inch of length. Rating the "Edgewound" resistor at 30 watts per inch for a 4,500-watt continuous-duty unit, it is said that the resistor weighs 48 lb., as compared with 80 lb. for the cast-iron grid.

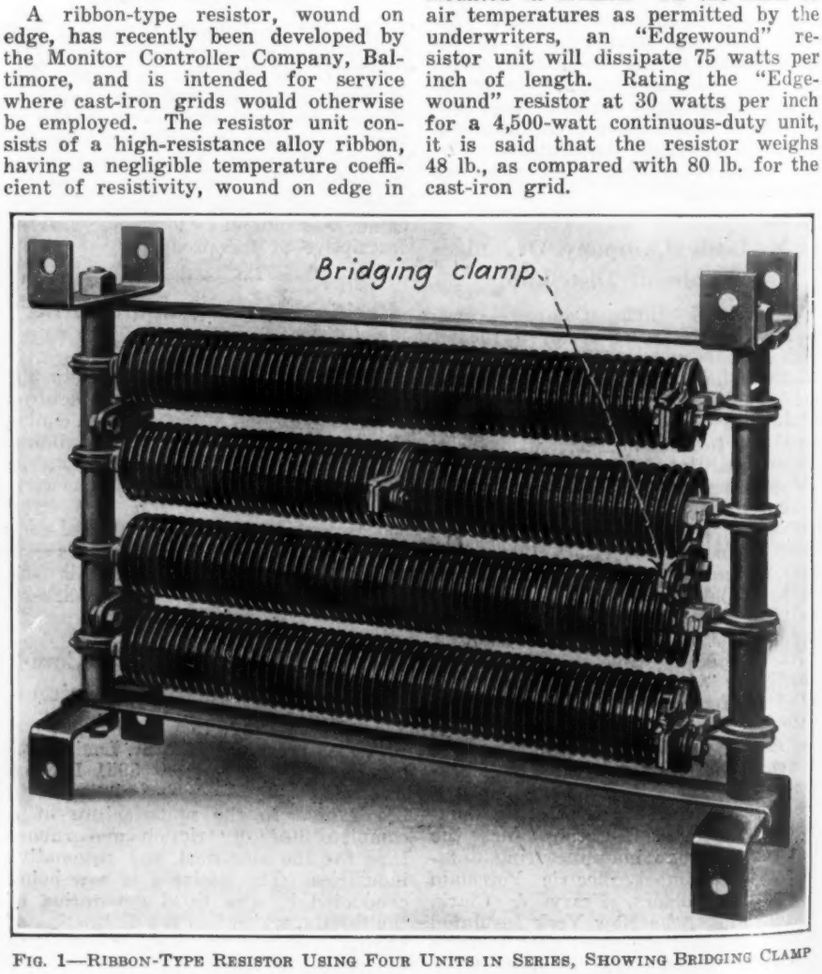


FIG. 1—RIBBON-TYPE RESISTOR USING FOUR UNITS IN SERIES, SHOWING BRIDGING CLAMP

New Trade Literature

THRUST BEARINGS.—Bulletin E, issued by the Kingsbury Machine Works, 4320 Tackawanna Street, Frankford, Philadelphia, covers the vertical adjustable types of the "Kingsbury" thrust bearings. Special attention is called to thrust bearings for hydro-electric generating units.

INDUSTRIAL APPARATUS.—The Condit Electrical Manufacturing Company, Boston, 27, has issued an "Industrial Hand Book" (No. 5,005, superseding No. 5,004). This book is devoted exclusively to small industrial apparatus, 750 volts or less, direct current and alternating-current, designed to conform to the requirements of the safety commissions and industrial underwriters.

MOTION-PICTURE FILMS. — "Motion Pictures" is the title of a booklet issued by the General Electric Company, Schenectady, N. Y., describing the twenty-two motion-picture films made and distributed by the company. The various films tell the story of the growth and application of electricity in different industries, the manufacture of electrical apparatus, research, development, etc.

CANDLE SOCKET.—The Hart & Hegeman Manufacturing Company, 342 Capitol Avenue, Hartford, Conn., is distributing a catalog page, supplement to catalog R, describing and illustrating the new "H. & H." adjustable-pull candle socket.

PROTECTIVE RELAYS.—"Silent Sentinels" is the title of a seventy-two-page booklet issued by the Westinghouse Electric & Manufacturing Company, Newark Works, Newark, N. J., on protective relays for alternating-current and direct-current systems. This publication, known as S. P. No. 1,666, is a comprehensive treatise on this subject and a valuable contribution to the art of relay practice.

FLOODLIGHT PROJECTORS.—Bulletin No. 2,064 issued by the Crouse-Hinds Company, Syracuse, N. Y., describes and illustrates its types RCA and RCE "Imperial" floodlight projectors. These projectors have a heat-resisting semaphore lens in the front door and a heat-resisting prismatic glass reflector on the inside of the rear door, which are not affected by lamp heat, gases, rain or snow.

HEATING EQUIPMENT.—F. J. Ryan & Company, Wesley Building, Philadelphia, have issued four new bulletins on their heating equipment, entitled "Electric Lead or Salt Bath Furnace," "Electric Furnace Resistor Supports," "Automatic Temperature Control" and "Electric Heating Furnaces Up to 1,800 Deg. F."

OIL-SLUDGING APPARATUS.—The De Laval Separator Company, 165 Broadway, New York City, has issued a leaflet which briefly discusses sludging of oil and its significance. It also describes an oil-testing device and the "De Laval" laboratory centrifuge.

BEARING HOUSING AND OIL WELL FOR MOTORS—The Century Electric Company, 1,827 Pine Street, St. Louis, is distributing a folder entitled "Bearing and Oil-Well Construction," in which it describes the bearing housing and oil well of the "Century" squirrel-cage induction polyphase motors.

OIL PURIFIERS.—The De Laval Separator Company, 165 Broadway, New York City, has issued bulletin No. 105, which covers the centrifugal purification of turbine and Diesel lubricating oil and also the dehydration of transformer, switch and other insulating oils. It shows how purifiers are used and the economies effected by their use and also contains some general information on miscellaneous lubricating problems. Several pages are devoted to illustrations showing the mechanical construction of "De Laval" purifiers and giving their dimensions.

AUTOMATIC MOTOR STARTERS AND JUNCTION BOX.—The Sundh Electric Company, Newark, N. J., has issued bulletins Nos. 6,000, 6,010, 6,020 and 6,030, entitled "Sundh Magnet Switch A.C. for Automatic Starter Across the Line Type, Undervoltage Release or Undervoltage Protection," "Sundh Automatic Starter Across the Line Type AC, Push-Button Pilot Control, Three-Wire, with Undervoltage Protection and Inverse-Time-Limit Overload Thermal Relay Protection;" "Sundh Automatic Starter Across the Line Type A.C. with Undervoltage Release or Undervoltage Protection and Inverse-Time-Limit Overload Relay Protection," and "Sundh Automatic Starter Across the Line Type A.C. with Undervoltage Release or Undervoltage Protection and Inverse-Time-Limit Overload Relay Protection, Inclosed New Junction Box, Combination Type, Air Break Ventilated, or Oil-Immersed," respectively, covering its automatic motor starters and junction box.

Construction News

Projects, Plans, Bids and Contracts, Contemplated or Under Way

New England States

BANGOR, ME.—The Shore Line Electric Company, recently organized, plans to supply electricity for lighting, heating and power purposes in the towns of Clinton, Lamoine, Hancock, Franklin, Sullivan, Winter Harbor, Prospect, Cherryfield, Harrington and other towns in Hancock and Washington Counties. Harry L. Wheelden, Bangor, is president.

FAIR HAVEN, VT.—The Vermont Milling Products Company is reported to be planning to install electric power equipment in connection with the rebuilding of its ground-slate plant, recently damaged by fire, with loss of about $400,000.

ESMOND, R. I.—Plans for the addition to the Esmond Mills, on which work is under way, include the installation of electric power equipment. The cost of the work is estimated at $300,000.

NEWPORT, R I.—Bids will be received by the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until Dec. 2, for three electric trolley hoists (Schedule 2975).

Middle Atlantic States

BROOKFIELD, N. Y.—The Town Board has awarded a contract to the Madison Power Company, Solsville, for street lighting for a period of five years. The contract calls for thirty lamps of from 60 cp. to 100 cp. The company will extends its lines from Leonardsville to Brookfield.

BUFFALO, N. Y.—Steps have been taken by the business men and property owners on Washington Street to secure an improved lighting system on that thoroughfare between Seneca and Chippewa Streets.

FREEDOM, N. Y.—The Public Service Commission has authorized the Municipal Electric Light Department of the village of Arcade to extend its electric system to the town of Freedom to serve electricity here.

LAWRENCE, N. Y.—Contract will soon be awarded for the installation of about 100 additional street lamps throughout the village. Street-lighting service is furnished by the Queens Borough Gas & Electric Company, Far Rockaway.

SPRINGWATER, N. Y.—The Public Service Commission has authorized the transfer of the franchises, electric plant and system of the Springwater Electric Light Company to the New York Central Electric Corporation, Perry.

LETCHWORTH VILLAGE, THIELLS, N. Y.—Bids will be received by the Superintendent of Purchases, Department of Architecture, Room 408, Capitol, Albany, until Dec. 4 for construction, heating, sanitary work and electric work of attendants' home (adult male group), four cottages for infirm group, hospital building at Letchworth Village. Sullivan W. Jones, Capitol, Albany, is state architect.

WATERVLIET, N. Y.—A plan whereby the Adirondack Power & Light Corporation, Schenectady, would erect a substation to cost about $100,000 in Watervliet for the distribution of electricity for this entire section has been submitted to the city officials by representatives of the company. The proposal involves an addition to substation at Twenty-fifth Street and the erection of a steel-tower, high-tension transmission line from the North Albany substation to the local substation.

BRIDGEPORT, N. J.—The Electric Company of New Jersey, Bridgeton, is considering extending its transmission lines from Swedesboro to Bridgeport to supply electrical service here.

BURLINGTON, N. J.—Plans for extensions and improvements at the East Burlington works of th eUnited States Cast Iron Pipe & Foundry Company, involving an expenditure of $1,500,000 include a building, 600 ft. long and 120 ft. wide, known as the foundry farm, to be equipped with three traveling cranes, one with 50-ft. span and two with 30-ft. spans; annealing shed and power house. The power plant will be divided into three parts, boiler plant, pumping plant and electrical plant. Adjacent to the power plant will be an outdoor substation. A complete fuel-storage and pumping system will be installed.

CHATHAM, N. J.—Bids will be received by the Board of Public Works at the office of Charles Prager, borough clerk, until Dec. 2 for pumping machinery as follows: (1) One 1,000,000-gal. pump, motor (2,300 volts, three-phase, 60 cycles) and gasoline-engine drive; (2) one 1,500,000-gal. pump, motor (2,300 volts, three-phase, 60 cycles) and gasoline-engine drive. The pumps to be for dual drive by gasoline engine and electric motor at 1,200 r.p.m.

ELIZABETH, N. J.—Steps have been taken by the East Jersey Street Improvement Association for the installation of an ornamental lighting system on that thoroughfare.

LODI, N. J.—The present street-lighting system on Union Street is to be replaced with arc lamps. New lamps are also to be installed on several other streets. Street-lighting service is supplied by the Public Service Electric Company, Newark.

LONGPORT, N. J.—Extension of the electric lighting system to Atlantic City at the Margate line is under consideration.

NEWARK, N. J.—Bids will be received by the Board of Education, City Hall, until Dec. 2 for electrical supplies and mechanical apparatus for city schools. Specifications are on file at the office of the Department of Supplies, third floor, City Hall. R. G. Argue is secretary.

POTTERSTOWN, N. J.—The New Jersey Power & Light Company, Dover, is securing the right-of-way for a new transmission line from Potterstown to Whitehouse.

BLANDON, PA.—The Metropolitan Edison Company, Reading, is contemplating extending its transmission line from Blandon to Maiden Creek, taking in the village of Half-Way House.

BROOKVILLE, PA.—The Penn Public Service Company, Johnstown, has taken over the system of the Solar Electric Company and will furnish service in this district. Extensions and improvements are planned in transmission lines.

FARRELL, PA.—The Borough Council is considering extensions to the police and fire-alarm systems in the outlying sections of the borough.

KINGSTON, PA.—The Luzerne County Gas & Electric Corporation is being organized by officials of the Luzerne County Gas & Electric Company to take over and consolidate the latter company and affiliated organizations. Plans are under consideration for transmission-line and other extensions.

PITTSBURGH, PA.—The City Council has ordered the installation of an improved lighting system on Penn, North Highland and Frankstown Avenues.

PITTSBURGH, PA.—The Duquesne Light Company has secured permission to construct a submarine cable crossing under the Ohio River, near Brunots Island, containing eight 22,000-volt wires.

SELINSGROVE, PA.—A site has been acquired by the Pennsylvania Realty & Investment Company, Allentown, at Hummels Wharf, 2 miles north of Selinsgrove, across the river from Sunbury, for the Pennsylvania Power & Light Company, Allentown, which, it is expected, will eventually build a superpower plant to be tied in with the contemplated 220-kv. transmission system of the company.

WEATHERLY, PA.—Plans are under consideration by the City Council for the installation of additional generating units in the municipal electric plant.

BALTIMORE, MD.—Bids will be received by the Board of Awards, office of the City Register, until Dec. 3, for automatic-control equipment for two electric turbo-generators, with accessories, at the Back River sewerage-treatment works. Specifications are on file at the office of the Highways Engineer Department, City Hall.

CHARLESTON, W. VA.—Notice has been given by the West Virginia Water & Electric Company that it will apply to the county court of Kanawha County for permission to extend its transmission lines along the county road, a distance of 3 miles.

LURAY, VA.—The Shenandoah River Light & Power Company and the Page Power Company have consolidated under the name of the latter. Extensions and improvements are contemplated to the systems.

WASHINGTON, D. C.—Bids will be received by the purchasing agent Post Office

Department, for seven rectifiers for charging storage batteries.

WASHINGTON, D. C.—Bids will be received by the Purchase and Issue Subdivision, United States Veterans' Bureau, until Dec. 18, for a number of motor-driven mixing machines (Circular G-52).

WASHINGTON, D. C.—Bids will be received by the general purchasing officer, Panama Canal, until Dec. 3, for a quantity of batteries, insulators, telephone cord, wire panelboard, headlights and kindred equipment (Circular 1639).

WASHINGTON, D. C.—Bids will be received at the office of the general purchasing officer, the Panama Canal, Washington, D. C., until Dec. 9 for master station, theater dimmers, voltmeter, copper tubing, cable clamps, cable clips, etc. (Circular 1640).

WASHINGTON, D. C.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Dec. 12 for a ventilating system for the telegraph offices, Treasury Building, Washington, D. C. For details see Searchlight Section.

WASHINGTON, D. C.—Bids will be received by the Bureau of Supplies and Accounts, Navy Department, until Dec. 9, for forty-seven electric drills for the South Brooklyn Navy Yard; two electric grinders for the Boston Navy Yard; six electric grinders for the Philadelphia Navy Yard; three electric grinders for the Mare Island Navy Yard; three electric hand drills for the Mare Island Navy Yard, and six electric hand drills for the Puget Sound Navy Yard (Schedule 2938); for miscellaneous dry and flashlight batteries for Eastern and Western yards (Schedule 2959); also, until Dec. 2, for sixty mica condensers and 1,100 porcelain insulators (Schedule 2950).

North Central States

DECKERVILLE, MICH. — The Great Lakes Power Company, Bad Axe, has taken over the municipal power station and will furnish service from a transmission line now in course of construction. The line will be extended to Deford for local service.

SNOVER, MICH.—The Great Lakes Power Company, Bad Axe, plans extensions and improvements in the local lighting system. A transmission line is being erected to furnish service here. The municipal electric station will be discontinued.

CLEVELAND, OHIO.—Bids will be received at the office of the Commissioner of Purchases and Supplies, City Hall, until Dec. 5 for underground cable for police signal system.

CLEVELAND, OHIO.—Bids will be received at the office of the Commissioner of Purchases and Supplies, City Hall, until Dec. 5 for paper insulated, lead covered cable for the Division of Light and Power.

INDIANAPOLIS, IND. — Preliminary plans are under way by the Interstate Public Service Company for the construction of three hydro-electric plants, two to be located on the Elkhart River, one at Baintertown, to cost about $200,000, and the other near New Benton, to cost about $250,000 and one on the St. Joe River, near New Bristol, to cost about $800,000. E. J. Albrecht, 35 Dearborn Street, Chicago, is consulting engineer.

CHICAGO, ILL.—The Illinois Central Railroad Company has entered into a ten-year agreement with the Commonwealth Edison Company to furnish power within the Chicago terminal district, to be supplied by the beginning of the summer of 1926, for operation of the suburban service. The amount of electricity called for under the agreement will be 30,000 hp. at the start. With completion of the electrification project, about 50,000 hp. will be required.

EASTON, ILL.—The Central Illinois Public Service Company, Springfield, has secured permission to acquire the property of the Easton Light & Power Company. A transmission line will be erected to furnish service here and at Teheran.

TREGO, WIS.—Plans are under way by the Wisconsin Hydro-Electric Company, Amery, for the construction of a hydro-electric plant on the Namakagan River at Trego. The project includes the erection of a transmission line from Trego to Spooner, a distance of about 19 miles.

IOWA FALLS, IOWA.—The Iowa Falls Electric Company has taken an option on the Harp mill property and water rights. If taken over, the company proposes to build a dam and power plant, to cost about $110,000.

LEWIS, IOWA.—The Iowa Service Company, Omaha, Neb., is preparing to erect a 33,000-volt transmission line from Marne to Lewis, a distance of 10 miles. A temporary substation will be installed in Lewis.

OSAGE, IOWA.—The Northeastern Iowa Power Company, Clermont, has acquired the dam site on the Cedar River at Osage, and has started work on the construction of a large dam just below the old one. The cost is estimated at $250,000.

REMSEN, IOWA.—Plans are under way by the Iowa Light, Heat & Power Company, Carroll, for the construction of a new substation in Remsen. When completed the new station will supply electricity to about a dozen towns in this vicinity.

BISMARCK, MO.—The plant and holdings of the Bismarck Electric Light & Power Company have been acquired by F. W. Graham and T. F. Bowdern, Longfellow Street and C. C. tracks, St. Louis. The new owners plan to erect a transmission line to Iron Mountain and Ironton.

KANSAS CITY, MO.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Dec. 11 for the new direct-current electric service at the United States post office and court house, Kansas City. For details see Searchlight Section.

BEULAH, N. D.—The Knife River Mining Company is contemplating the construction of a power plant in Beulah.

Southern States

ALBEMARLE, N. C.—The Central Power Company has applied to the Federal Power Company for a preliminary permit to construct diversion dams and power projects on the New and Reddies Rivers in Wilkes, Ashe and Allegheny Counties.

HIGH POINT, N. C.—The North Carolina Public Service Company, Greensboro, contemplates the erection of a feeder line, to cost about $15,000.

MATTHEWS, N. C. — Bonds to the amount of $30,000 have been sold, the proceeds to be used for the installation of a new lighting system.

PANTEGO, N. C.—The Board of Aldermen has arranged for a bond issue for the installation of an electric lighting system.

CLINTON, S. C.—The City Council is considering calling an election to vote on the proposal to issue $15,000 of bonds for street lighting and $25,000 for waterworks system. J. Newton Johnston is city engineer.

COLUMBIA, S. C.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Dec. 17 for the installation of one electric passenger elevator, hoistway, etc., in the United States post office and custom house at Columbia, S. C. For details see Searchlight Section.

FORT VALLEY, GA.—The Atlantic Ice & Coal Corporation, Washington Street Viaduct, Atlanta, plans to install electric power equipment in its proposed local ice-manufacturing and refrigerating plant, to be used by the Fruit Growers Express, to cost about $700,000.

TAMPA, FLA.—Steps have been taken by the North Fourth Street Property Owners' Association for the installation of an ornamental street-lighting system in the Gandy Bridge district.

ASHLAND CITY, TENN.—Plans are being considered by the Nashville (Tenn.) Street Railway & Light Company for the erection of a transmission line to Ashland City, to cost about $17,000.

HUNTINGDON, TENN. — The citizens have voted to authorize the Mayor and Board of Aldermen to sell the municipal electric plant to the Kentucky-Tennessee Light & Power Company, Guthrie, Ky., and to extend its transmission line to Huntingdon. The company is also considering extending the line to Hollow Rock Junction and Hollow Rock.

MOBILE, ALA.—The City Council is considering the installation of an ornamental lighting system on Government Street.

MARIANNA, ARK.—The Arkansas Utilities Company has purchased the property of the People's Electric Company. Plans are under way for the erection of a 33,000-volt transmission line from Helena, to Marianna. The company has been granted permission to issue $150,000 in bonds, the proceeds to be used for the new transmission line and other expansion.

VINTON, LA.—A franchise has been granted by the Calcasieu Parish Grand Jury to the Orange (Tex.) Ice, Light & Water Company to extend its light and power lines from Vinton to DeQuincy, a distance of 40 miles.

ARDMORE, OKLA. — The Consumers' Light & Power Company contemplates extensions and improvements to its system, to cost about $100,000.

DUSTIN, OKLA.—The City Council is considering the erection of a transmission line to connect with the system of the Oklahoma Power Company, Okmulgee, to cost about $25,000. The proposed line will replace the service provided by the local power plant, recently destroyed by fire.

HEAVENER, OKLA. — The Oklahoma Gas & Electric Company, Oklahoma City, plans to reconstruct its local distributing at once. New poles and wires will be erected in the business section and improvements will be made in certain parts of the residence districts.

LAWTON, OKLA.—Plans are under consideration by the Southwestern Light & Power Company for the installation of additional equipment in its local plant, to cost about $200,000. The equipment will include another steam turbine and a battery of boilers, etc.

CANADIAN, TEX.—Bonds to the amount of $65,000 have been voted for extensions and improvements to the municipal electric plant.

DALLAS, TEX.—The Dallas Power & Light Company plans to build a substation at 1717-27 Kelly Street, to cost about $75,000.

GONZALES, TEX.—The Central Power & Light Company, Frost Building, San Antonio, has acquired the systems of the Gonzales Water Power Company and the Gonzales Electric Light Company. Extensions to both plants, including the installation of additional machinery, is contemplated.

LONGWORTH, TEX.—The West Texas Utilities Company, Abilene, has begun preliminary work on the erection of a transmission line from Roby to Longworth to furnish electricity here. The project is said to include a new local substation.

Pacific and Mountain States

KALAMA, WASH.—Application has been filed with the Supervisor of Hydraulics by the Commissioners of the Port of Kalama for a permit to establish the Lake Merrill reservoir in connection with a proposed large hydro-electric plant. The cost of the project is estimated at $1,100,000.

SEATTLE, WASH.—The City of Seattle has applied to the Federal Power Commission for permission to utilize a power site on Ruby Creek.

SEATTLE, WASH.—The City Council has authorized the installation of an ornamental lighting system on Fifth Avenue from Seneca to Jackson Street. A resolution providing for improvement of Shoreland Drive, including paving, sewers, street lamps, etc., has been adopted by the Council.

TACOMA, WASH.—The City Council has authorized the installation of an improved lighting system on Sixth Avenue, between Pine and Proctor Streets, and on portions of North Thirty-seventh Street and Mason Avenue.

BAKER, ORE.—The Eastern Oregon Light & Power Company plans to erect a transmission line in this section in connection with a proposed 1,400-hp. hydro-electric plant on the Grand Ronde River.

CULVER CITY, CAL.—The Metro-Goldwin-Mayer Studios have plans for the construction of a power house at their motion-picture plant at 7200 Washington Boulevard.

OAKLAND, CAL.—The Southern Pacific Railroad Company plans to install a turbo-generator and accessory equipment at its Fruitvale power station.

LOS ANGELES, CAL.—The City Council is considering the installation of an ornamental lighting system on Anaheim Street, consisting of forty-one concrete standards, and also, on Beverly Boulevard, comprising eighty-eight pressed steel standards.

SAN BERNARDINO, CAL. — Electric power equipment will be installed in the mechanical and printing plant to be erected at Fourth and D Streets by the Sun Company, to cost about $250,000.

STOCKTON, CAL.—All bids submitted Nov. 19 for police and fire-alarm systems throughout the city have been rejected. New bids, it is understood, will be asked. W. B. Hogan is city engineer.

HOLLY, MONT.—The Holly Sugar Corporation, Kittredge Building, Denver, Colo., is planning to build a power plant at its proposed local sugar mill, to cost about $1,000,000.

Electrical Patents

Announced by U. S. Patent Office

(Issued October 28, 1924)

1,513,407. INCANDESCENT LAMP; Arthur L. Lombos, New York, N. Y. App. filed March 25, 1921. With a plurality of filaments having equal or different capacities, with means for producing a plurality of independent electric circuits for the filaments.

1,513,436. MAGNETIC WORK-HANDLING IMPLEMENT; Gotthold E. Volz, Detroit, Mich. App. filed Dec. 14, 1923. Used in punch-press operation, etc.

1,513,441. HALF-DUPLEX MORSE CARRIER SYSTEM; Herman A. Affel, Brooklyn, N. Y. App. filed Aug. 11, 1921. Employing carrier currents for transmission purposes.

1,513,450, 1,513,451, 1,513,452, 1,513,453. HALF-DUPLEX MORSE CARRIER SYSTEM; Lloyd Espenschied, Queens, N. Y. App. filed Aug. 11, 1921. Employing carrier currents for transmission purposes.

1,513,489. COMBINATION ELECTRIC LANTERN AND SPOTLIGHT; William H. Calhoun, New York, N. Y. App. filed May 5, 1922.

1,513,533. LANTERN; Clarence L. Cobb, Baltimore, Md. App. filed June 2, 1923. Electric signal lantern.

1,513,551, 1,513,554. MAGNETO; William W. Hawkins, Brooklyn, N. Y. App. filed Feb. 20, 1922. Of the oscillator type.

1,513,558. METHOD OF AND APPARATUS FOR DETERMINING ION CONCENTRATION; Henry C. Parker, Philadelphia, Pa. App. filed May 16, 1924.

1,513,633. APPARATUS FOR REGULATING THE VOLTAGE OF ALTERNATING-CURRENT SYSTEMS; Otto Scheller, Berlin-Lichterfelde-West, Germany. App. filed Aug. 31, 1921.

1,513,656. INSULATING CAP FOR ELECTRICAL CABLE JOINTS; Frederick M. Van Gelderen, Enschede, Netherlands. App. filed April 27, 1923. For making a connection without soldering.

1,513,707. TRANSMISSION AND RECEIVING SYSTEM; John H. Hammond, Jr., Gloucester, Mass. App. filed Oct. 30, 1923. Wireless.

1,513,713. ELECTRICALLY HEATED UTENSIL; Frederick S. McCullough, Wilkinsburg, Pa. App. filed Oct. 8, 1923. As soldering irons, sadirons, etc.

(Issued November 4, 1924)

1,513,728. ELECTRODE STRUCTURE AND METHOD OF MANUFACTURING SAME; W. G. Allan, Toronto, Ontario, Canada. App. filed Sept. 2, 1920. For electrolytic decomposition of water.

1,513,754. ELECTRIC FURNACE; E. A. A. Grönwall, Stockholm, Sweden. App. filed Sept. 28, 1921. Open type, such as used in the manufacture of pig iron.

1,513,760. FOREIGN-POTENTIAL-DETECTING DEVICE; W. H. Martin, New York, N. Y. App. filed Jan. 5, 1921. Applicable to telephone subscriber's line circuit.

1,513,761. HIGH-FREQUENCY COMPOSITE SET; H. S. Osborne, New York, N. Y. App. filed June 3, 1919. Using carrier currents for the transmission of signals.

1,513,768. TELEPHONE DISINFECTING DEVICE; W. H. Stowell, Mamaroneck, N. Y. App. filed Nov. 1, 1923.

1,513,777. AUTOMATIC TELEPHONE SYSTEM; B. D. Willis, Oak Park, Ill. App. filed Sept. 22, 1920.

1,513,799. SHORT-CIRCUITING DEVICE; H. L. Brump, Dayton, Ohio. App. filed July 26, 1923. For repulsion induction motors.

1,513,825. TELEPHONE SYSTEM; L. D. Kellogg, Deerfield, Ill. App. filed Jan. 30, 1922. Private automatic exchange systems.

1,513,852. OZONIZER; F. G. Niece, Cleveland, Ohio. App. filed Dec. 15, 1919.

1,513,872. CIRCUIT CONTROL EXTENSION FOR ELECTRIC LAMPS; L. G. Sturdy, Joliet, Ill. App. filed June 2, 1921. Pendent switch.

1,513,892. DYNAMO REGULATOR; F. H. Bullinger, Yonkers, N. Y. App. filed Dec. 17, 1920. For variable-speed dynamos such as those used in farm-lighting plants.

1,513,913. STORAGE BATTERY; C. Kingsley, Washington, D. C. App. filed Sept. 18, 1920. Solid unit multi-cell type.

1,513,924. TELEPHONE HEAD SET; W. J. Murdock, Chelsea, Mass. App. filed May 12, 1921. Two-element unit.

1,513,927. ELECTRIC HEATING COIL; L. R. Oakes, Tipton, Ind. App. filed Nov. 14, 1922. For use in heating incubators and similar devices.

1,513,958. ELECTRICAL RELAY; F. Bergmann, Bedford, England. App. filed March 16, 1921. For use in association with controllers for electric motors for slowing down the motor on occurrence of an overload in excess of a predetermined amount, without actually opening the circuit to the motor.

1,513,973. RADIO TELEPHONY; F. M. Doolittle, New Haven, Conn. App. filed Feb. 21, 1924. Method of transmitting and receiving radio-telephonic impulses.

1,513,993. ELECTRICAL CONTROL APPARATUS FOR SECURING SHAFT SYNCHRONISM; C. L. Howse, Detroit, Mich. App. filed March 31, 1921.

1,514,006. VARIOCOUPLER; F. N. Merwin, St. Louis, Mo. App. filed Feb. 21, 1923.

1,514,042. ELECTRICAL CONDUIT; W. H. Friedrich, Dyer, Ind. App. filed Dec. 20, 1923. For inclosing signal and other wires used along railway tracks.

1,514,056. STORAGE BATTERY; J. W. Leitzen, Mapleton, Iowa. App. filed April 17, 1922. Means for connecting the service conductors to the terminals.

1,514,074. ELECTRIC SMOOTHING IRON; E. Barth, Stuttgart-Ostheim, Germany. App. filed Sept. 24, 1921.

1,514,085. HEATER CONTROL; S. W. Huff and W. J. Quinn, New York, N. Y. App. filed June 11, 1921. For steam or other systems.

1,514,088. ELECTRICAL CIRCUIT CONTROL; W. B. Kennedy, San Francisco, Cal. App. filed Oct. 23, 1922. Rheostat, for use in flatirons, etc.

1,514,093. ELECTRIC GENERATING APPARATUS AND METHOD; C. W. Miles, Anderson Township, Hamilton County, Ohio. App. filed Oct. 6, 1919. Using a wind motor.

1,514,123. AMPLIFIER; V. A. Bacevicz, Syracuse, N. Y. App. filed April 26, 1922. For the amplification of resistance variations in an electrical circuit by means of a shifting light beam.

1,514,148. CURRENT-SUPPLY SYSTEM FOR MOBILE ELECTRICAL MACHINES; N. R. Forssblad, Vasteras, Sweden. App. filed Oct. 23, 1922. Such as tractors supplied with current through an insulated cable arranged to be wound on and off a drum mounted on the carriage.

1,514,152. EAR CUSHION; H. Gernsback, New York, N. Y. App. filed Dec. 28, 1923. For telephone receivers.

1,514,193. AUTOMATIC TELEPHONE SYSTEM; W. A. Benson, Chicago, Ill. App. filed July 26, 1921.

1,514,194. SOCKET; J. Blackburn, St. Louis, Mo. App. filed Dec. 27, 1920. Molded out of bakelite.

1,514,215. MEASURED-SERVICE TELEPHONE SYSTEM; T. G. Martin, Chicago, Ill. App. filed May 15, 1919.

1,514,228. ELECTRIC HEATER; H. Price, Boston, Mass. App. filed Feb. 5, 1923. Bowl reflecting type.

1,514,231. CONTROLLING ALTERNATOR FOR SUPPLYING TUBE TRANSMITTERS; W. Schäffer, Berlin, Germany. App. filed May 3, 1922.

1,514,240. AUTOMATIC TELEPHONE SYSTEM; B. D. Willis, Oak Park, Ill. App. filed Dec. 3, 1919.

1,514,268. CONTROLLING MECHANISM; D. V. Stewart, Columbiana, Ohio. App. filed July 19, 1923. For automatically controlling the flow of electric current to the electrodes of a furnace.

1,514,287. ELECTRIC HEATER; L. P. Hynes, Albany, N. Y. App. filed Aug. 19, 1922. Railway-car type.

1,514,288. ELECTRICALLY HEATED ROLLER; L. P. Hynes, Albany, N. Y. App. filed Jan. 3, 1923.

1,514,292. ARMORED CONDUCTOR; H. G. Knoderer, Englewood, N. J. App. filed Jan. 26, 1921. Especially intended for surface extensions.

1,514,295. CONDENSER; J. F. Lindberg, Chicago, Ill. App. filed July 5, 1922. As used in radio.

1,514,305. WINDMILL; D. R. Scholes, Chicago, Ill. App. filed Dec. 1, 1921. For generating electric current with which storage batteries may be charged, etc.

1,514,314. CIRCUIT-CONTINUING DEVICE; H. A. Douglas, Bronson, Mich. App. filed April 4, 1921. As used with reflecting lamp to insure proper focus.

1,514,321. COMMUTATOR; W. H. Jeffrey, Toledo, Ohio. App. filed Oct. 2, 1922. Using a split insulating spool placed over the spider.

1,514,322. VARIABLE-COIL STRUCTURE; A. A. Kent, Ardmore, Pa. App. filed Oct. 16, 1923. For radio use.

1,514,353. REGISTER AND INDICATOR; W. G. Thomas, Blue Hill, Me. App. filed Nov. 7, 1919. Whereby an operator at a given point may control a plurality of indicators.

1,514,363. SEMI-AUTOMATIC TELEPHONE SYSTEM; G. A. Betulander, Sodertorns, Villastad, and N. G. Palmgren, Stockholm, Sweden. App. filed Feb. 22, 1921.

1,514,369. ELECTRIC CONDENSER; H. A. Bremer, Chicago, Ill. App. filed Sept. 21, 1923. As used in radio.

1,514,408. CABLE CONNECTOR; G. C. Thomas, Jr., Elizabeth, N. J. App filed Jan. 22, 1924. For joining cables to electric box fixtures as outlet boxes.

1,514,413. REPAIR UNIT FOR ELECTRIC LAMPS; J. L. Adams, San Diego, Cal. App. filed Oct. 25, 1921.

1,514,416. INDUCTIVE COUPLING DEVICE; S. Ballantine, Boonton, N. J. App. filed Dec. 19, 1922. For use as a coupling element between two audions.

1,514,421. CONTROL SYSTEM FOR LATHES; H. L. Blood, North Plainfield, N. J. App. filed Oct. 7, 1921.

1,514,430. ELECTRIC SOLDERING MACHINE; H. L. Burns and R. T. Abrell, Dayton, Ohio. App. filed June 9, 1921.

1,514,444. TERMINAL CONNECTION FOR CHARGING STORAGE BATTERIES; C. F. Duchanois, Youngstown, Ohio. App. filed July 10, 1919.

1,514,474. VARIABLE-SPEED INDUCTION MOTOR; R. E. Stewart, Los Angeles, Cal. App. filed Nov. 9, 1921.

1,514,492. WELDING TOOL; H. V. Wille and L. A. Rehfuss, Philadelphia, Pa. App. filed Jan. 13, 1922. The metal to be welded can be preheated or cut with the same tool that makes the welds.

1,514,523. ELECTRIC MOTOR STARTER; J. A. Hirst, Chester, England. App. filed Aug. 8, 1924. Motor-starting switch.

1,514,544. AUTOMATIC CORD ADJUSTER; A. J. Lang, New York, N. Y. App. filed May 12, 1921. For sadirons, etc.

1,514,546. MOTOR CONTROLLER; R. Lee, Milwaukee, Wis. App. filed Sept. 14, 1923. Foot-operated for use with dental or other small motors.

1,514,549. SOLDERING IRON; A. Llano, Brooklyn, N. Y. App. filed July 26, 1924.

1,514,555. ELECTRICAL TESTING DEVICE; J. H. Meehan, Leadville, Col. App. filed Aug. 30, 1922. For testing lamps, fuses, etc.

1,514,570. AUTOMATIC RECLOSING CIRCUIT-BREAKER SYSTEM; G. H. Roosevelt, Tacoma, Wash. App. filed Aug. 7, 1923.

1,514,576. REGULATING SYSTEM; L. W. Thompson, Schenectady, N. Y. App. file Feb. 10, 1923. Using armature reaction to control the excitation of the generator.

1,514,582. CIGAR LIGHTER; C. W. Mabey, Indianapolis, Ind. App. filed Feb. 3, 1923.

1,514,591, 1,514,592. ELECTRICAL APPARATUS; J. S. Smyser, Harwich, Mass. App. filed May 29, 1922. Means for regulating, controlling or indicating the operation of electrical or electrically energized apparatus.

(Issued November 11, 1924)

1,514,612. CONDUIT FITTING; E. M. Glasgow, Port Chester, N. Y. App. filed Sept. 21, 1922. Provided with a roller to permit easy pulling of the cable.

1,514,616. FITTING FOR LIGHTING PURPOSES; H. T. Harrison, Westminster, England. App. filed Sept. 16, 1920. For street lighting.

1,514,618. TERMINAL STRIP; H. H. Ide, La Grange, Ill. App. filed July 12, 1920. With terminals arranged in banks or strips.

1,514,625. LINE SWITCHES AND CONNECTIONS THEREFOR; F. A. Lundquist and J. A. Kropp, Chicago, Ill. App. filed Aug. 26, 1920. For use in automatic telephone exchanges.

1,514,628. ELECTRIC HEAT-GENERATING APPLIANCE; A. Pritzker, Toronto, Ontario, Canada. App. filed April 17, 1922. For cooking ranges, hot plates, electric heating, etc.

1,514,642. FUSE INDICATOR; E. W. Werden, Mount Vernon, N. Y. App. filed Nov. 18, 1922.

1,514,645. PRIVATE-BRANCH EXCHANGE CIRCUITS; R. S. Bailey, Montclair, N. J. App. filed Oct. 25, 1920. Link circuit arrangement for branch telephone exchange.

1,514,648. DIRECTIVE RADIO SYSTEM; R. Bown, East Orange, N. J. App. filed Nov. 12, 1920.

1,514,661. RADIO RECEIVING AND TRANSMITTING SYSTEM; M. W. Haub, Alhambra, Cal. App. filed Nov. 6, 1922.

1,514,670. BATTERY; A. E. Melchior, Oakdale, La. App. filed June 19, 1922. Storage type with interchangeable units.

1,514,682. ELECTRIC VAPORIZER; H. Wilson, Detroit, Mich. App. filed May 3, 1923. Vapor inhalers.

1,514,699. METHOD AND APPARATUS FOR WIRELESS CONTROL FOR TORPEDOES, ETC. E. C. Hanson, Washington, D. C. App. filed Aug. 1, 1921.

1,514,701. TRANSMISSION CIRCUITS; J. W. Horton, Bloomfield, N. J. App. filed Sept. 30, 1922. With provisions for testing the vacuum-tube amplifiers.

1,514,705. VACUUM-TUBE REPEATER CIRCUITS; B. W. Kendall, New York, N. Y. App. filed Aug. 14, 1919.

1,514,718. TELEPHONE SYSTEM; H. W. O'Neill, Brooklyn, N. Y. App. filed Dec. 9, 1922. Toll connection circuit.

Financial and Corporate

Utility Market Improves

Numerous Issues Gain Moderately, but a Few Stocks Go Up in Brisk Fashion

IMPROVEMENT in the list as a whole but with special strength in a few favorite issues about summarizes the market for the week in utility stocks Despite continued heavy dealing in the railroad securities, power and light stocks are commanding more and more attention. Weak spots here and there, such as Cities Service and Middle West Utilities, did not check an improvement in the general tone. The North American Company's common stock, which sold as low as 22 earlier in the year and was selling at 34 a fortnight ago, ran up five or six points to a new high The company is earning at the rate of $5.44 per share on its common stock. and a good many investors came to the conclusion that the stock was behind the market. Public Service Corporation of New Jersey closed the week three or four points above the level of a week ago, the rise in these two issues being the features of the week among the listed utility stocks.

Persistent buying continues both in the shares of the Alabama Traction, Light & Power Company, which last week moved from 76 to a new high at 83 and in the stock of the Southeastern Power & Light Company, which at 42 and a fraction also set a new top record. Both issues last week were listed on the New York curb market, but the major trading in the stocks still is on the outside market. Two other stocks suddenly turned strong last week—Northern Ontario Light & Power, which gained about six points on the week, and Republic Railway & Light, which gained about eight points. Toward the close of the period particular strength developed in National Power & Light Company's stock. A range of something like twenty points was recorded between the lowest and highest prices.

New Capital Issues

During the week ended November 25 electric light and power financing was moderate, a four-million-dollar issue by the Penn Public Service Corporation being the largest issue of that type of security. This flotation was in the form of first and refunding mortgage 5 per cent gold bonds, maturing in 1954 and offered at 94 and interest, yielding over 5.40 per cent. The proceeds of this issue will be used in part to refund $2,350,000 series B 7½ per cent bonds which are to be called for payment on January 1 and to reimburse the company in part for expenditures already made for property additions. The Northern New York Utilities. Inc., contributed $1,750,000 in first lien and refunding 5½ per cent bonds, the price being 97½ and interest, to yield about 5.70 per cent. The Central Iowa Power & Light Company again participated in the week's financing to the amount of $1,000,000 in 7 per cent convertible general mortgage gold bonds offered at 100. This company was represented in last week's capital issues by an offering of $6,500,000 first mortgage 6 per cent bonds. The Platte Valley Power & Light Company offered a short-term issue of first lien bonds totaling $800,000, bearing interest at the rate of 6 per cent and maturing in 1926. Another small issue was floated by the Atlantic City Electric Company, an offering of first and refunding mortgage bonds totaling $750,000.

Customer Stock Sales Total $17,720,000 in September

Based upon monthly reports received by the ELECTRICAL WORLD from electric light and power companies selling stock of the company direct to customers or employees, it is estimated that during September a total of 179,775 shares were sold in this manner. The total value of this stock is estimated at $17,720,000 and 33,800 customers or employees bought the stock. The average sale to each such purchaser amounted to $525.

Cleveland Electric Illuminating

A Prosperous North American Unit That, in Financing a New Plant, Plans a Bond of Newest Type—Entirely New Mortgage Created

BY PAUL WILLARD GARRETT

THE Cleveland Electric Illuminating Company, which now is one of the principal subsidiaries of the North American Company, was incorporated in 1892, but its rise to a favored position among utilities has been within the last decade. The solid growth of the company over a period of years in a highly industrial center and with excellent public relations where radical sentiment is supposed to prevail draws particular attention to the Cleveland utility.

Nearly eleven years ago, on December 31, 1913, the company's plant investment was $17,094,083 and the combined reserves and surplus were $1,438,927. The balance sheet recently compiled as of October 31, 1924, presents a very different record from the one just referred to. It shows a plant investment of $58,568,698 with combined reserves and surplus of $17,154,895. The great industrial growth in Cleveland automatically has given the company an increasing volume of business, but a part of the improvement is the result of far-sighted conservative management.

While the Cleveland Electric Illuminating Company's gross business by steady yearly gains has increased from $4,262,866 to $18,296,881 in ten years, the demand for service is growing so persistently that the company now is planning to build another large generating plant. At present Cleveland is supplied with electricity generated at the Lake Shore station, thought to be the world's largest steam-electric plant under one roof, which has a capacity of 384,000 hp. A 50,000-hp. central steam-heating plant will be

BUSINESS OF THE CLEVELAND ELECTRIC ILLUMINATING COMPANY HAS INCREASED MORE THAN 30 PER CENT IN LAST TEN YEARS

Stock and Bond Quotations of Electric Light and Power and Manufacturing Companies

(Prices on New York stock market unless otherwise noted. Unless otherwise noted the par, stated, or preference value of stocks is $100.

Companies	Bid Price Saturday, Nov. 22	Low 1924	High 1924
PREFERRED STOCKS			
Operating Companies			
Adirondack Power & Light 7 per cent	a 97½	94	97½
Appalachian Power, 7 per cent	a 90	85½	90
Arkansas Light & Power 7 per cent	a 91	81	96
Asheville Power & Light 7 per cent	a 95	95	99
Central Illinois Public Service 6 per cent	84	84	87
Colorado Power 7 per cent	a 92	90	98
Connecticut Light & Power 7 per cent	a103	99	106
Consumers' Power 6 per cent	a 90	85	93
Dayton Power & Light 6 per cent	84	84	90
Duquesne Light 7 per cent	105	103½	107½
Eastern Texas Electric 6 per cent	a105	81	105
Empire District Electric 6 per cent	a 73	70	78
Fort Worth Power & Light 7 per cent	a 99	97	102
Great Western Power 7 per cent	97	96	99
Illinois Northern Utilities 6 per cent	a 82	82	87
Illinois Power & Light 7 per cent	a 92	84	95
Kansas Gas & Electric 7 per cent	a 94	92	97
Long Island Lighting 7 per cent	99	95½	102
Minnesota Power & Light 6 per cent	89	78	89
Mississippi River Power 6 per cent	a 87½	80	90
Nebraska Power 7 per cent	96	89	99
Niagara Falls Power 7 per cent—25	27½	26	29
Niagara, Lockport & Ont. Power 7 per cent	a101½	99½	104½
Northern States Power 7 per cent	a 96	91	97
Ohio Public Service 7 per cent	a 93	86	100
Pacific Gas & Electric 6 per cent	a 90	85½	92½
Penn-Ohio Power & Light 7 per cent	90	84	96½
Pennsylvania Power & Light $7—no par	98½	93	99
Penn. Public Service 7 per cent	a 90	90	100
‡Philadelphia Electric 8 per cent—25	38½	29½	39½
Southern California Edison 8 per cent	a116	112	120
Tennessee Electric Power, 6 per cent	a 69	47	71
Texas Power & Light 7 per cent	97	95	97½
Utah Power & Light 7 per cent	96	94	96½
Western States Gas & Electric 7 per cent	a 80	78	85
Yadkin River Power, 7 per cent	98	94	98
Holding Companies			
American Gas & Electric 6 per cent—50	a 45½	41½	46
American Light & Traction	a 92½	91	94½
American Power & Light 6 per cent	a 89½	84	91
American Public Service 7 per cent	a 88	84	92
American Public Utilities 7 per cent	a 88	73	88
American Water Works & Electric 7 per cent	a 97½	89½	99
Associated Gas & Electric 7 per cent—1 per cent extra—50	a 49	49	50½
Carolina Power & Light 7 per cent	a 99	95½	101
Central Indiana Power 7 per cent	88	80	93
Cities Service 6 per cent	a 81	67	83
Commonwealth Power 6 per cent	a 80	72	82
Consolidated Gas 6 per cent—50	a 57	51	59½
Continental Gas & Electric 7 per cent pr. pf	a 89	69	93
Electric Bond & Share 6 per cent	a102	96½	103
General Gas & Electric—$8—no par	a105	96	105
*Middle West Utilities 7 per cent	a 92	80	92
National Power & Light—$7—no par	a 93	84	96½
North American 6 per cent—50	a 48	43½	50½
Northern Ohio Electric	a 27	16	34
Public Service Corp. of N. J. 7 per cent	100	96½	100½
Public Service Corp. of N. J. 8 per cent	a109½	99½	110
Standard Gas & Electric 8 per cent—50	a 49½	46½	49½
†United Gas Improvement—50	58	55½	58
United Light & Power—$6.50—no par	83½	75½	84
COMMON STOCKS			
Operating Companies			
Adirondack Power & Light—50	a 30	22½	34
Appalachian Power—no par	a 70½	66	93
Arkansas Light & Power	a 60	22	63
Brooklyn Edison	a118½	107½	120½
Buffalo General Electric	a151	118	155
Colorado Power	a 33½	21	35
*Commonwealth Edison	a132½	126	135
§Consolidated Gas, Electric Light & Power	a 32½	32½	37½
Dayton Power & Light	a153	70	160
Detroit Edison	110	101½	110½
|| Edison Electric Illuminating of Boston	a188	163½	190
*Kentucky Hydro-Electric	87½	84	87½
Long Island Lighting	200	100	200
Mississippi River Power	a 32½	18½	34
Montana Power	67	61½	71
Niagara Falls Power—no par	a 42	42	48
Niagara, Lockport & Ontario Power—no par	a 51	45	59
Northern Ohio Electric—no par	a 10	5	16
Northern States Power	a101	92	106
North Texas Electric	a 58	58	84
Pacific Gas & Electric	a 99½	90½	99½
‡Penn Central Light & Power—no par	59½	57	60
§Pennsylvania Water & Power	a130	98½	135½
‡Philadelphia Electric—25	a 38½	29	39½
*Public Service Co. of Northern Illinois	a102½	97	104
Puget Sound Power & Light	a 51	43½	61½
Southern California Edison	a103	95	106
Tampa Electric	a169	134	169
Tennessee Electric Power—no par	a 43	20	45
Virginia Power	a 50	16	70
Virginia Railway & Power	a 63	36	72½
West Penn. Co.	83	47½	98
Holding Companies			
‡American Electric Power—50	62	22½	62½
American Gas & Electric—no par	a105½	43½	105½
American Light & Traction	a135	115	148
American Power & Light	a 47	34½	48½
American Public Utilities	a 80	35	97
American Water Works & Electric	a116	40	126½
Carolina Power & Light—no par	a230	82½	245
Cities Service	a165	140	187
Columbia Gas & Electric—no par	a 45½	33	46½
Commonwealth Power Corp.—no par	a 98½	56	109
Consolidated Gas—no par	a 75½	60½	77
Continental Gas & Electric	a 80	49	96
Federal Light and Traction	a101	75	102
General Gas & Electric	a 56	22	63
Lehigh Power Securities—no par	a 82½	31	89
*Middle West Utilities—no par	a 74	41	86
National Power & Light—no par	a168	60	190
North American—10	a 38	22	38
Philadelphia Co.—50	a 50	42½	53½
Power Securities—no par	a 14½	4	14½
Public Service Corp. of N. J.—no par	a 66½	39	67½
Standard Gas & Electric—no par	a 39	31½	40½
United Gas & Electric (Conn.)—no par	a 29	14	42
Utah Securities	a 35½	16½	37

Companies			Bid Price Saturday, Nov. 22	Low 1924	High 1924
BONDS					
Operating Companies					
Adirondack Power & Light	6s	1950	a102	97½	103
Alabama Power	5s	1946	a 96½	90½	97
Appalachian Power	5s	1941	a 96	89	96
Brooklyn Edison	5s	1949	a100	97½	102½
	6s	1930	a104½	102½	106½
	7s	1940	107½	107	110½
Cleveland Electric Illuminating	5s	1939	a101	98½	101
Commonwealth Edison	5s	1943	a 99½	95	100
	5s	1953	a 98½	92	99½
§Consol. Gas, Elec. Lt. & Pwr.	4½s	1935	95½	91	96
	6s	1949	106	102½	106
Consumers' Power	5s	1936	a 98½	94½	99½
	5s	1952	a 91½	87	92½
Detroit Edison	5s	1933	a101	99	101½
Duquesne Light	6s	1949	a105½	103½	106½
Great Western Power	5s	1946	95	90½	96
Kansas City Power & Light	5s	1952	a 95	89	96
Mississippi River Power	5s	1951	a 97	92	97½
Montana Power	5s	1943	a 98½	95	99
New England Power	5s	1951	a100½	97	101
New York Edison	6½s	1941	a114	109½	114½
Niagara Falls Power	6s	1950	105½	104	105½
Northern States Power	5s	1941	a 94	89½	94½
	6s	1941	104½	101	104½
Ohio Power	7s	1951	a106½	103	106½
Pacific Gas & Electric	5s	1942	a 94½	90½	95
Pennsylvania Water & Power	5s	1940	a 99½	96	100
‡Philadelphia Electric	5s	1966	a101	97	103½
	5½s	1947	104½	99½	105
	6s	1941	107	103½	107½
Portland Electric Power	6s	1947	94½	89½	97
Southern California Edison	5s	1939	a 99½	96	100
	6s	1944	102½	100	103½
Tennessee Electric Power	6s	1947	a 99	93½	99
Texas Power & Light	5s	1937	97	91½	97
Toledo Edison	7s	1941	a109½	106	110
Utah Power & Light	6s	1944	a 91½	87½	93½
Holding Companies					
Alabama Traction, Light & Power	5s	1962	a 84½	65½	86
American Gas & Electric	6s	2014	a 95	94	95½
American Power & Light	6s	2016	a 93½	91	94½
Amer. Water Works & Electric	5s	1934	a 93	84½	94
Associated Gas & Electric	6½s	1954	94½	92½	94½
Central Indiana Power	6s	1947	a 95½	88	96
Commonwealth Power	6s	1947	a 97½	87	98
Consolidated Cities Lt., Pwr. & Tr.	5s	1962	a 75	64	76½
Illinois Power & Light	6s	1953	a 99½	95	100½
United Light & Railways	5s	1932	94	87½	94½
	6s	1952	96	92	97½
ELECTRICAL MANUFACTURING COMPANIES					
PREFERRED STOCKS					
Allis-Chalmers Manufacturing			a101½	90	101½
*National Carbon			118½	112	125
Worthington Pump & Machinery—A			87	68	87
COMMON STOCKS					
Allis-Chalmers Manufacturing			a 67½	41½	67½
American Bosch Magneto—no par			a 28½	22½	38½
Electric Storage Battery—no par			a 62½	50½	64
General Electric			a271½	193½	281
General Electric—10			a 11½	10½	11½
*Hurley Machine—no par			63	48	66
†Wagner Electric			24½	20	34½
Westinghouse Electric & Manufacturing—50			a 64½	55½	65½
Worthington Pump & Machinery			a 48½	23½	50½
BONDS					
Canada General Electric	6s	1942	a107½	102½	107½
General Electric	3½s	1942	83	80	84
	5s	1952	105½	100	105½
Robbins & Myers	7s	1952	67	66	91½
†Wagner Electric Manufacturing	7s	....	100	97	101
Western Electric	5s	1944	a 98½	96	99½
Westinghouse Electric & Mfg.	7s	1931	a108½	106½	109½

*Chicago Stock Exchange. †St. Louis Stock Exchange. ‡Philadelphia Stock Exchange. || Boston Stock Exchange. § Baltimore Stock Exchange.
a Bid price Tuesday, November 25.

completed by January, 1925. The steam plant to be constructed at Avon, Ohio, which has been discussed recently in connection with the company's new financing, when completed will have a capacity of 400,000 hp. Investors familiar with operating problems will appreciate a point in connection with the new plant. It, like the Lake Shore station, which has the four largest pulverized-fuel boiler units in the world, will burn coal powdered as fine as talcum and at a temperature of 3,000 deg.

The Cleveland Electric Illuminating Company now is financing such expenditures as that entailed by the Avon plant by offerings of rights to subscribe to $5,281,700 of 6 per cent preferred stock at par and $1,584,000 of common stock at $150 per share, but the details of the new $11,500,000 bonds are what present the most interesting phase of the new financing.

ENTIRELY NEW MORTGAGE

The company's mortgage bonds with which investors heretofore have been familiar, the first 5's of 1939, outstanding to the amount of $18,500,000, have an authorized limit of $30,000,000. It is perfectly obvious now that the remaining $11,500,000 of bonds authorized would not finance requirements for very long. A new mortgage would have to be created in a few years, anyway, so the management decided to do the job now before more underlying bonds are issued and while money conditions are favorable to borrowers. The company thus has created a new mortgage on the entire physical property, pledging as additional security the remaining authorized first mortgage bonds.

The new general mortgage of the Cleveland company possesses all features that the bankers could devise to make and keep it sound. Since it has no authorized limit, the company may issue bonds for an indefinite period under this mortgage provided the conditions are carried out. Various coupons may be attached to different series of general mortgage bonds and various maturity dates.

With a plant investment of $58,568,698, the company on October 31 had bonds outstanding to the amount of $23,500,000 and capital stock of $25,845,300. From the standpoints both of property and capitalization, therefore, the amount of bonds is conservative. Such considerations are among those that give Cleveland Electric Illuminating bonds rank with our very best power and light obligations and explain why the offerings recently of general mortgage 5's were taken quickly by investors at par or on a 5 per cent yield basis.

Net earnings have grown from $2,184,669 ten years ago to $8,543,433 for the twelve months ended October 31, 1924, the latter figure being the sizable amount available for interest charges of only $1,281,894. Net earnings available for interest charges for five years have averaged more than four and three-quarters times all such charges, an uncommonly wide margin for bonds of the character under discussion. The Cleveland Electric Illuminating Company has paid dividends continuously to its common stockholders since 1902. Such a record helps to season the bonds, but the large sums turned back into the property as reserves and surplus are what sweeten all Cleveland Electric Illuminating securities.

Electrical Stocks Rise

Manufacturing Issues, Led by General Electric, Have Improved Since Election

ONE group of industrial stocks that has attracted attention since election, and which turned upward sharply following the news of conservative victories, is that representing electrical manufacturing companies. Such advances are all the more interesting since there had been an important forward swing in issues connected with power and light activities earlier this year, investors feeling, apparently, that the utility business was destined to improve no matter how the November vote went. The big rise in railroad stocks did not start until after election, because investors feared radical legislation. Presumably the improvement in the market position of the electrical manufacturing stocks since election forecasts a still greater improvement in general business conditions than had been anticipated. The electrical industry has been moving forward despite depression in many branches of industry and despite the bad agricultural situation. It will improve more rapidly, of course, if the business cycle now carries us to more prosperous days.

A few electrical manufacturing stocks are tabulated below, giving the quotation for November 3, the recent high and the net gain at that level since election:

	Nov. 3	Recent High	Gain
Allis-Chalmers Manufacturing	59	66	7
American Bosch Magneto	26	29¼	3¼
Electric Storage Battery	59	64	5
General Electric	255	278	23
Westinghouse Electric & Manufacturing	63	65¼	2¼
Worthington Pump & Machinery	41½	50½	9

Company Reports

Among the company reports issued during the past week for the month of October are the following:

Name of Company	Gross Revenues for October 1924	1923
American Water Works & Electric and subsidiaries	$3,172,774	$3,144,935
Central Power & Light*	358,133	315,556
Cities Service	1,163,814	1,049,915
Great Western Power	644,186	596,134
Kansas City Power & Light	768,744	723,785
Massachusetts Lighting	312,614	300,513
Niagara, Lockport & Ontario Power and subsidiaries	518,427	490,443
Pine Bluff Company	85,507	79,183
Republic Railway & Light	853,562	825,051
Virginia Railway & Power	888,846	880,061
West Penn Company	2,085,759	2,056,574

* September.

Detroit Edison Reports Largest Earnings in Its History. — For the twelve months ended October 31 the Detroit Edison Company reports gross earnings of $33,738,872, the largest in its history. For the same period net income of more than $5,907,000 was reported, which is $10.62 per share of the capital stock oustanding on October 31.

Dividends Declared

The following quarterly dividends were announced by central-station companies and electrical manufacturing companies during the past week:

Name of Company	Per Cent	When Payable
Associated Gas & Electric, pf	87½c	Jan. 2
Calumet Gas & Electric, pf	1¾	Dec. 17
Cities Service, monthly*	½	Jan. 1
Cities Service, monthly†	1½	Jan. 1
Cities Service, pf	½	Jan. 1
Cities Servce, preference B	½	Jan. 1
Consolidated Gas, Elec. Lt. & Pwr. of Baltimore, com	50c	Jan. 2
Consolidated Gas, Elec. Lt. & Pwr. of Baltimore, pf. A	2	Jan. 2
Consolidated Gas, Elec. Lt. & Pwr. of Baltimore, pf. B	1¾	Jan. 2
Consolidated Gas, Elec. Lt. & Pwr. of Baltimore, pf. C	1¾	Jan. 2
Oklahoma Gas & Electric, pf	1¾	Dec. 15
Standard Gas & Electric, pf	2	Dec. 15
Fairbanks, Morse & Company	65c	Dec. 31
Radio Corporation of America, pf	1¾	Jan. 1

* In cash scrip † In stock scrip

Canadian General Electric to Retire Debentures. — The Canadian General Electric Company, Ltd., is planning to retire its debenture debt outstanding to the amount of $5,000,000 in 6 per cent debentures due in 1942. A special meeting of shareholders has been called for December 5 to authorize the issuance of 52,000 shares of preferred stock and 52,000 shares of common stock with the purpose of obtaining funds to retire the outstanding debentures.

Westinghouse Electric Stockholders Quadruple in Past Ten Years. — The number of stockholders of the Westinghouse Electric & Manufacturing Company has more than quadrupled during the past ten years according to a recent report. In April, 1914, there were 9,400 stockholders, and in August, 1924, the number had increased to 38,600. During this period the capital stock of the Westinghouse company rose from $40,698,897 to $118,503,150. The ratio of the increase of stockholders to capital during this period is four to three.

Jersey Power Combination Approved. —The Board of Public Utility Commissioners of New Jersey has approved of the merger, recently announced in the ELECTRICAL WORLD, of the Burlington Electric Light & Power Company, the Citizens' Electric Light, Heat & Power Company, the Middlesex Electric Light & Power Company, the Morristown Gas Light Company, the Nicholas Electric Light & Power Company of Nutley, the Princeton Light, Heat & Power Company and the Weehawken Contracting Company into the Public Service Gas & Electric Company. All franchises, rights, property and obligations become the property of the Public Service Company. The amount paid for the stock of the merged concerns was $790,000 in promissory notes. The amount paid to each company was: Burlington Electric, $17,550 for 351 shares at $50 par value; Citizens' Electric, $41,400 for 1,656 shares at $25 par value; Middlesex Electric, $175,000 for 1,750 shares at $100 par value; Morristown Gas, $367,500 for 7,350 shares at $50 par value; Nicholas Electric, $25,000 for 500 shares at $50 par value; Princeton Light, $122,500 for 2,450 shares at $50 par value, and Weehawken Contracting, $41,050 for 821 shares at $50 par value.